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ABSTRACT

An empirical approach is taken to the problem of predicting effects of student financial aid programs on postsecondary enrollment rates and patterns. A model of students' enrollment decisions is developed and used to estimate the likely effects of alternative award policies for the Basic Educational Opportunity Grant (BEOG) program. The analysis is based on data from the National Longitudinal Study of the High School Class of 1972. The empirical approach provides a means for analyzing individuals' choices among a finite number of mutually exclusive alternatives and may be of interest to researchers dealing with problems of that type in education or elsewhere. The model can be applied to analyses of a wide variety of student financial aid policies at the state or federal level. The results are addressed to federal policymakers and others concerned with the consequences of BEOG award policies for students and for institutions. (Author/MSE)

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THE ENROLLMENT EFFECTS OF FEDERAL STUDENT AID POLICIES

PREPARED FOR THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
AND FOR LILLY ENDOWMENT, INCORPORATED

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PREFACE

This report presents an empirical approach to the problem of predicting the effects of student financial aid programs on postsecondary enrollment rates and patterns. The authors develop a model of students' postsecondary enrollment decisions; they then use the model to estimate the likely effects of alternative award policies for the Basic Educational Opportunity Grant (BEOG) program. The analysis is based on data from the National Longitudinal Study of the High School Class of 1972.

The empirical approach and the model of students' enrollment choices were developed with support from the Lilly Endowment, Inc. A contract with the Office of the Assistant Secretary for Planning and Evaluation, Department of Health, Education, and Welfare, provided support for the simulations of the enrollment effects of alternative BEOG policies.

The empirical approach provides a means for analyzing individuals' choices among a finite number of mutually exclusive alternatives and should be of interest to researchers dealing with problems of that type, in education or elsewhere. The model can be applied to analyses of a wide variety of student financial aid policies at the state or federal level and should be of interest to policymakers concerned with issues in that area. The results are addressed to federal policymakers and others concerned with the consequences of BEOG award policies for students and for institutions.

The authors are indebted to Cary Barnes, North Carolina State University, and William Goggin and Martin Kramer, the Office of the Assistant Secretary for Planning and Evaluation, DHEW, for their advice and assistance over the course of the project. They also thank Charles Manski, Carnegie-Mellon University, Marc Nerlove, Northwestern University, and T. Paul Schultz, Yale University, for their helpful criticisms and suggestions on an early draft of this report.

SUMMARY

This report presents a model for predicting the effects of alternative federal policies for student financial aid on postsecondary enrollment rates and patterns. We apply the model to exploring the effects of ten Basic Educational Opportunity Grant (BEOG) aid rules currently under consideration. Our data source is the National Longitudinal Study (NLS) of the High School Class of 1972 conducted by the National Center for Educational Statistics.

SELECTING THE MODEL

We tested two different enrollment models and chose the superior one for use in this study. The first, developed by the Inner City Fund, models students' enrollment behavior as a hierarchical sequence of binary choices between one type of institution and all remaining postsecondary alternatives. The other, developed in a previous Rand study, models students' characteristics as functions of the attributes of the institutions they attend, and uses Bayes' theorem to obtain the probability that a given student will attend a given institution. The data were randomly divided into two equal subsamples. Both models were estimated on the first subsample and used to "predict" the enrollment distribution of the students in the second. The Bayesian model proved to be much less expensive, far more flexible, and more accurate. We used it in the subsequent simulations.

POLICY ALTERNATIVES

Officials in the Office of the Assistant Secretary for Planning and Evaluation, Department of Health, Education, and Welfare selected ten policies for the simulation.

The first five policies retain the basic structure of the current program, which entitles the student to the maximum of a ceiling minus his or her family's contribution, a percentage of the student's cost, and a percentage of the student's need. They vary the award parameters as follows:

Policy Alternative	Ceiling	Percentage of Cost	Percentage of Need
1	$1400	50	100
2	1400	100	50
3	1400	100	100
4	2000	100	50
5	1800	50	100

The sixth policy replicates the award parameters of the fifth, but assumes a scheduled reduction with a $1400 effective ceiling.

The seventh policy pertains to a set of award rules designed to make grants more sensitive to tuition level; a student's grant is the:

$$\text{Greater of} \begin{cases} 1/2 \text{ (need - \$1200), or the} \\ \text{Lesser of} \begin{cases} \text{\$1800 - family contribution, or} \\ 1/2 \text{ need.} \end{cases} \end{cases}$$

The eighth policy is a set of award rules proposed by the Consortium on Financing Higher Education. A student would receive $1400 minus his or her family contribution plus the:

$$\text{Lesser of} \begin{cases} \text{\$1500 or} \\ 1/2 \text{ [instructional costs - \$1200 - (family contribution - \$1400)]} \end{cases}$$

Representative Albert Quie of Minnesota has proposed that a grant be 50 percent of the student's need for costs up to $2400 plus 25 percent of the student's need for costs between $2401 and $4000. The ninth policy incorporates these rules.

Finally, the tenth policy is a proportional need-sharing plan whereby an award is simply 35 percent of need.

A $200 minimum grant rule is imposed in all cases.

RESULTS

We estimate that the various BEOG policies would stimulate 3 to 5 percent increases in the numbers of students going on to colleges and universities. With high school graduates expected to number about 3.15 million annually in the late 1970s, this means that between 40 and 60 thousand more high school graduates would go on to college each

year.

We estimate that the fourth and sixth policies would have the greatest effects on *total* collegiate enrollments. The fourth would have a relatively large effect (but not the largest) on the percentage of students going on to private colleges: an increase of over 8 percent. The effects of the sixth would be largely concentrated in the public sector, where it is substantially more effective than any of the other policies. Considering private sector enrollments separately, it appears that the seventh and ninth policies would have the greatest effect, followed by the fourth and tenth. These policies would stimulate an additional 8 to 10 percent of graduates to enroll in private colleges; the first, second, and third policies would have the least effect: about a 3 percent increase.

After the sixth policy, the next strongest public enrollment policies are the third, fourth, and fifth, which would increase the numbers of high school graduates entering public institutions by about 4 percent. The tenth policy would have the smallest effect: an increase of about 3 percent.

It appears that women would be much more responsive to the policies than men. The policies would stimulate 4 to 6 percent increases in the numbers of white and nonwhite female high school graduates going on to college. The numbers of white males doing so would increase 2 to 3 percent, and of nonwhite males, only about 1 percent.

The policies would increase the number of low-income (family income less than $6000) high school graduates going on to college by 18 to 33 percent, and of low-middle-income ($6000 to $9999) graduates by 6 to 10 percent. The effects of the policies on students whose family incomes exceed $10,000 are negligible.

The policies would have relatively little effect on high-ability students: only 2 to 3 percent increases in the number going on to college. Students in the center of the ability distribution are more responsive (3 to 7 percent). And students in the low-ability quartile would exhibit the greatest response (4 to 10 percent).

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I. INTRODUCTION

PURPOSE

This report predicts the effects of ten federal financial aid policies on postsecondary enrollment rates and patterns. It is addressed primarily to federal policymakers and others concerned with distributing aid through the Basic Educational Opportunity Grant (BEOG) Program. We obtained the projections by modelling the effects of financial aid on the postsecondary enrollment behavior of students in the 1972 National Longitudinal Study, and then simulating their responses to the various policies.

THE BEOG PROGRAM

BEOG grant recipients may use their funds to defray educational expenses at the postsecondary school of their choice, including public and private vocational-technical schools, colleges, and universities. The size of a student's grant depends on the cost of attending his or her chosen institution,* the "family contribution" (an estimate of the student's and the family's ability to finance postsecondary education),** and four award parameters:

(1) A maximum, or ceiling (currently $1800);

(2) A percentage of the cost of attending the chosen school (currently 50 percent);

(3) A percentage (currently 100 percent) of the student's "need" (the cost of attending the school less the family contribution); and

(4) A minimum (currently $200).

Specifically, a student is entitled to the maximum of the ceiling minus the family contribution, the percentage of the student's cost, and the

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*The cost of attending a school includes tuition and fees, room and board costs, an allowance for personal expenses ($400), and books and supplies ($150). Students living at home or renting from third parties are allowed $1100 for room and board.

**A student's family contribution is determined by a complex sequence of calculations involving family resources (the student's and family's income and assets), family size, the number of family members pursuing postsecondary education, and allowances for certain expenses.

percentage of the student's need, provided that the grant exceeds the minimum.

The BEOG awards reduce the cost of postsecondary education for low-income and moderate-income students and enable more of them to continue their education beyond high school. Since the grants change the relative prices (costs net of aid) of attending various schools, they presumably affect the distribution of students among institutions as well.

A host of issues confront policymakers concerned with determining BEOG award rules: How will the redistribution of students affect college revenues, from both student enrollees and state subsidies? To what extent would a specified increase in the ceiling improve the rate at which low-income students go on to college? Would a change in the proportion-of-cost constraint, or in the proportion-of-need constraint, or in the ceiling, affect the range of postsecondary educational options financially available to low-income students? What kinds of changes in the award rules would be needed to improve the financial position of the private sector? What would be the cost to the Federal Government of any particular set of award rules?* Each of these, and other, questions can be approached by anticipating the enrollment effects of hypothesized BEOG award rules. That is the focus of our research.

SIMULATING ENROLLMENT EFFECTS

We tested two different models. One, developed by the Inner City Fund [1], models students' enrollment behavior as a hierarchical sequence of binary choices between institutions of certain types and all remaining postsecondary alternatives. The other, developed in a previous Rand study [2], models students' characteristics as functions of the attributes of the institutions they attend and uses Bayes' theorem to obtain the probability that a given student will attend a given institution [2]. We fitted each model to a subsample of the National Longitudinal Study of High School Seniors From the Class of 1972, and then predicted the distribution of the students in a complementary subsample. The Bayesian

*For all practical purposes, the BEOG program each year becomes uncontrollable once the award rules are established.

model proved to be much less expensive, far more flexible, and more accurate. We used it in the subsequent simulations.*

The model can simulate the enrollment distribution of students induced by any set of BEOG award rules. Officials in the Office of the Assistant Secretary for Planning and Evaluation, Department of Health, Education, and Welfare provided ten sets of BEOG award rules that represent the major policy alternatives now being considered. For each policy, we make enrollment projections for a nationally weighted sample of students. We also describe how the simulation program might be applied to investigating other policies.

OUTLINE

Section II describes the Bayesian model of postsecondary enrollments, including the theoretical and empirical consideration applied in fitting parameters. A parallel discussion of the ICF model is given in Sec. III; the performance comparison outcomes are also indicated there. Section IV describes the simulation study, identifies the ten policies, and presents the major results. Further applications of the simulation program are described in Sec. V.

Details of the model-fitting and simulation procedures are deferred to the appendixes. Appendix A describes the data. Appendix B describes the strategies used to organize the simulation study data. Finally, Appendix C presents various tables further summarizing the results of the simulation study.

*A previous study [2] compared the Bayesian model with a model that employed the conditional logit (or multinomial) approach. There, too, the Bayesian approach yielded a more accurate, less expensive, and more flexible model.

II. A MODEL OF STUDENTS' POSTSECONDARY ENROLLMENT BEHAVIOR

This section describes our model of students' postsecondary enrollment behavior. We begin by outlining our approach to the problem of estimating the probability $P(j|i)$ that student i makes postsecondary choice j. (For purposes of this study, a student's postsecondary choices include enrolling at a specific institution of higher education, enrolling in any noncollegiate postsecondary school (i.e., a vocational-technical school), or not continuing his or her education.) We then describe the available data and our estimation procedures. Finally, we carry out these procedures and present a test of the model's predictive accuracy.

THE STRUCTURE OF THE MODEL

Our basic idea is to use existing data to model first the joint probability distribution $P(i,j)$ of student characteristics i and postsecondary choices j. The student characteristics include high school curriculum, ability, income, high school location, and financial aid awards. The postsecondary choices include no more education, a vocational-technical school, and collegiate institutions; for colleges, we have available such attributes as quality, cost, type, and location. Given a suitably parameterized model for these variables and choices, we simulate student behavior by computing the conditional distribution $P(j|i)$ of choices, given the student characteristics.

The following (oversimplified) example illustrates the main ideas. Assume that the only available student characteristic is an indicator of whether his or her income is high or low, and that the student might choose between a junior college and a university. The data might show that 100 students are distributed as follows:

Income	Type of Institution: UN	JC
HI	30	10
LOW	20	40

The model would then simply be

$$P(HI,UN) = .3,\ P(HI,JC) = 1,\ P(LOW,UN) = .2,\ P(LOW,JC) = .4.$$

Now, to simulate the behavior of a new student, we would use the conditional distribution for his or her income level; e.g.:

$$P(UN|HI) = .75,\ P(JC|HI) = .25,$$
$$P(UN|LOW) = .33,\ P(JC|LOW) = .67.$$

Our major problem is that there are numerous student characteristics and choices to consider, and the data are in no way sufficient to enable us to write down simple empirical probabilities across them. We therefore develop parametric models for the joint probabilities, models that are largely empirical and that attempt to summarize the major elements of variation in a table like the above. $P(i,j)$ is expressed first as the product of $P(i|j)$, the distribution of characteristics given choice, and $P(j)$, the marginal distribution of choices; Bayes' Theorem is then used to obtain $P(j|i)$. In fitting our models, we chose to focus on four student characteristics and only a few attributes of choice, treating these for the most part as continuous variables in our formulas.

Formally, let X_i denote the i*th* student's vector of characteristics, and Z_{ij} the j*th* choice's vector of attributes with respect to the i*th* student. We assume that $P(j)$ is simply proportional to the number of students who made that choice, and hence the bulk of our work consists of obtaining a convenient parameterization for $P(i|j)$ in terms of X_i and Z_{ij}. To apply the model: If the i*th* student has K available options,

Bayes' Theorem yields

$$P(j|i) = P(j)P(i|j) \Big/ \sum_{k=1}^{K} P(k)P(i|k).$$

DATA

Sources

Data on the characteristics of institutions of higher education were obtained from the 1972 Institutional Domain File, compiled by the American Council on Education.

Data on student characteristics and choices were obtained from the National Longitudinal Study (NLS), a national random sample of high school seniors from the class of 1972. The NLS includes 22,532 students from over 1300 high schools, but nonresponse problems forced us to drop 8401 students, leaving 14,131. Appendix A provides details on these and other data processing steps.

Variables

It seemed practical (and prudent) to concentrate on a few of the important student characteristics in building our probability models. Previous studies demonstrated the importance of such student characteristics as race, sex, ability, family income, high school location, and high school curriculum. Similarly, we focused on a small subset of institutional attributes--type of institution, cost, quality, financial aid, and location--which previous research has shown to be important in students' enrollment decisions. Below, we briefly describe how these variables were constructed.

Student Race and Sex. We stratified the NLS sample into four groups by race (nonwhite and white) and sex, and performed separate analyses for each group.

Student Ability. The NLS includes a battery of standardized tests that provide measures of students' achievement in six areas. We use the sum of a student's (standardized) scores on four parts--reading, letter groups, mathematics, and vocabulary--as the measure of his or

her ability.*

Student Family Income. We used student-reported family income where available. Family incomes of nonreporting students were imputed on the basis of their parents' occupations and educational levels. Appendix A describes the imputation procedure.

Student Location. We obtained the latitude and longitude of each NLS high school. We reasoned that this would be a satisfactory approximation of students' places of residence.

Student High School Curriculum. We define a dichotomous variable according to whether or not the student had been in a college preparatory or academic track in high school.

Option Type. We clustered students' postsecondary options into eight mutually exclusive and exhaustive categories or types. The no-more-education option includes all postsecondary activities other than full-time attendance at some postsecondary school. The vocational-technical option includes full-time enrollment at any noncollegiate school. The remaining option types comprise full-time enrollment in the six collegiate sectors: 1) public two-year colleges; 2) low-tuition (less than $465) public four-year colleges or universities; 3) high-tuition ($465 or more) public four-year institutions; and 4) low- (less than $1210), 5) medium- (between $1210 and $1725), and 6) high-tuition ($1725 or more) private colleges and universities.**

We also estimated models employing alternative clusterings of collegiate options, stratifying the public and private sectors by level--two-year college, four-year college, university--in one case, and by selectivity--low, medium, high--in another. The three models yielded equally accurate predictions of the complementary-sample students' enrollment distributions (in the sense of the sum of the absolute deviations between the predicted and absolute distributions). We opted for the clustering-by-cost approach because it was more closely related

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*This index was suggested by the results of a previous analysis of students' performance on the NLS test battery. See Ref. 3, p. 15.

**In the 1972-73 academic year, average tuition and fees at public four-year institutions amounted to $465, at private two-year colleges $1210, and at private four-year institutions $1725. See Ref. 4, p. vii.

to policymakers' concerns.

Institutional Cost. We estimate the cost of attending an institution of higher education as the sum of tuition and fees, room and board, and $550 (an allowance for personal expenses of $400 and $150 for books and supplies). Tuition and fees were obtained from the Institutional Domain File if available. College catalogs were consulted where the data were missing. Room and board was assumed to be zero if the institution was within 30 miles (great-circle distance) of a student. For institutions farther away, we used the information provided by the Institutional Domain File, if available, and consulted college catalogs where the data were missing. In the case of institutions that did not provide room and board facilities, we assumed the 1972-73 national average room and board costs of $615 for public two-year colleges, $945 for public four-year schools, and $910 and $1035 for private two-year and four-year institutions [4, p. vii].*

Institutional Quality. The Institutional Domain File contains the average Scholastic Aptitude Test score (math + verbal) for students at each institution. We use this as the measure of an institution's quality.

Financial Aid. We aggregate the student's reports of the amounts of aid he or she received from various sources by type of aid: scholarships (and grants), loans, and work-study. Veterans Administration and Social Security educational benefits are included in scholarships. Funds from the student's and the family's personal resources are not included in the aid variables.

FITTING THE MODEL

Because distance is undefined for the no-more-education option, and because we lack data on the locations of vocational-technical schools, we use a two-stage procedure to estimate student choice probabilities. First, we estimate the probability that a student chooses each option, conditional on his or her high school curriculum, ability, and income. Then, we estimate the probability that a student chooses each collegiate

*Tuition and fees were missing for about 4 percent of the institutions. Room and board costs were missing for about 3 percent of the schools providing room and board facilities. About 50 percent of the schools, nearly all of which were two-year colleges, did not provide these facilities.

institution, conditional on the location of his or her high school.

Formally, let f_1 be the conditional probability of a student having been in an academic track (Y_1) in high school, given his or her ability (Y_2), percentile income (Y_3), and choice (Z_{ij});* f_2, the joint distribution of ability and percentile income, conditional on choice; and P(j), the marginal probability of choice. The first-stage probability P(j|i) that student i chooses j is proportional to

$$f_1 (Y_1|Y_2, Y_3, Z_{ij}) f_2(Y_2, Y_3|Z_{ij}) P(j).$$

For collegiate institutions, the second-stage probability P'(j|i) is proportional to

$$f_3 (Y_4|Z_{ij}) P(j|i),$$

where f_3 is the conditional distribution of log distance (Y_4), given choice. P(j|i) is normalized to sum to one, and P'(j|i) is normalized to sum to one minus the first-stage probability of no-more-education minus the first-stage probability of attending a vocational-technical school.

ESTIMATING THE DISTRIBUTION OF STUDENT CHARACTERISTICS

To allow for a test of the model's predictive accuracy, we randomly divided the NLS database into two subsamples called the "fitting" and "test" samples. The fitting sample contained 7109 students and was used to derive the distribution of student characteristics.

High School Curriculum

We assume that f_1 has a logit formulation and use the conditional logit maximum likelihood technique to estimate the distribution of student high school curriculum--a dichotomous variable having value one if the student was in a college preparatory track in high school.

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*We assume that random components in the choice of high school curriculum are uncorrelated with random components in the choice of postsecondary option.

Table 1 presents the results. The equations have option type main effects and student ability by option type interactions. We note that there is substantial variation in the coefficients within each equation. Tests for the importance of the main effects and of the option type by ability interactions showed these terms to be generally significant.

The coefficients generally have the right signs. Higher-ability students are more likely to have been in an academic track regardless of their postsecondary choice. At the mean, students who went on to college are more likely to have been in an academic track than those who did not. And, at the mean, students who chose higher-cost public schools and medium- and higher-cost private schools are more likely to have been in the college preparatory track than those who went to public two-year and lower-cost four-year institutions and to lower-cost private colleges and universities.

Ability

We assume that f_2 is a bivariate normal density, and estimate its parameters by means of ordinary least-squares. We regressed student ability on option type and the interaction of option type and institutional quality. Table 2 presents the results. The coefficients are generally significant and exhibit the right signs.

Students who went on to a vocational-technical school tend to have higher ability than those who did not continue their education, and students who went on to college are generally of higher ability than the vocational-technical enrollees. Students who attended a higher-quality school of any collegiate type tend to have higher ability than students who attended a lower-quality institution of the same type. Controlling for institutional quality, the more costly collegiate types (higher-cost public four-year and all three private categories) tend to attract more able students than do the public two-year and lower-cost four-year institutions.

To verify our normality assumptions, we looked at a random sample of 200 observations and plotted residuals separately against predicted values, institutional type, and quality to look for departures from the homoscedastic patterns; we also looked at normal probability

Table 1

RESULTS OF HIGH SCHOOL TRACK EQUATION[a]

Variable	Student Type			
	White Male	White Female	Nonwhite Male	Nonwhite Female
Constant[b]	-7.914	-9.637	-4.500	-4.584
	(-13.68)	(-14.22)	(-6.43)	(-5.55)
Optional type dummies				
Vocational-technical	1.319	1.687	-1.263	.733
	(0.64)	(1.03)	(-0.36)	(0.26)
Public two-year	3.297	2.513	-2.657	- .103
	(2.91)	(1.86)	(-1.46)	(-0.05)
Low-tuition public four-year	1.788	4.505	-2.124	.401
	(1.37)	(3.38)	(1.18)	(0.02)
High-tuition public four-year	.539	6.340	-3.589	4.629
	(0.17)	(2.63)	(-0.89)	(1.15)
Low-tuition private	2.053	1.688	-1.438	-6.667
	(1.05)	(0.70)	(-0.46)	(-1.28)
Medium-tuition private	-5.439	- .129	-1.415	-13.522
	(-1.32)	(-0.03)	(-0.21)	(-1.08)
High-tuition private	6.169	10.583	1.884	- .629
	(1.69)	(3.36)	(0.30)	(-0.08)
Option type-by ability interactions				
No more education	.030	.040	.019	.018
	(12.02)	(12.55)	(4.81)	(3.78)
Vocational-technical	.025	.036	.026	.015
	(2.63)	(5.13)	(1.39)	(0.99)
Public two-year	.019	.035	.036	.020
	(3.99)	(6.34)	(4.13)	(1.88)
Low-tuition public four-year	.029	.027	.014	.026
	(5.34)	(5.24)	(1.67)	(3.59)
High-tuition public four-year	.039	.022	.048	.008
	(2.76)	(2.21)	(2.32)	(0.44)
Low-tuition private	.028	.040	.018	.064
	(3.20)	(3.81)	(1.17)	(2.29)
Medium-tuition private	.068	.050	.030	.735
	(3.38)	(2.86)	(0.85)	(1.12)
High-tuition private	.015	.005	.023	.038
	(0.98)	(0.35)	(0.82)	(0.94)
Number of observations	2735	2828	736	810

[a]The functional form for the probability that a student of a given race and sex was in an academic high school curriculum is

$$1/(1 + \exp - \hat{\beta}'x),$$

where β is the appropriate column of coefficients and x is the corresponding vector of characteristics. The coefficients in the table are the maximum likelihood estimates for $\hat{\beta}$.

[b]Excluded dummy is the no-more-education option; asymptotic T-statistics given in parentheses.

Table 2

RESULTS OF ABILITY REGRESSIONS

Variable	Student Type			
	White Male	White Female	Nonwhite Male	Nonwhite Female
Constant[a]	194.35 (275.53)	195.99 (283.16)	166.41 (127.54)	166.20 (136.30)
Option-type dummies				
Vocational-technical	8.53 (3.28)	7.1 (3.59)	2.14 (0.38)	3.45 (0.95)
Public two-year	-30.28 (-1.10)	70.06 (3.49)	-40.76 (0.91)	-7.16 (-0.21)
Low-tuition public four-year	-24.31 (-1.90)	-49.56 (-3.82)	-36.53 (-1.91)	-16.35 (-1.12)
High-tuition public four-year	-20.94 (-1.02)	-51.53 (-2.05)	-128.93 (-3.07)	25.55 (0.98)
Low-tuition private	-58.66 (-2.60)	-22.81 (-1.06)	-85.46 (-1.74)	-31.51 (-1.30)
Medium-tuition private	-64.31 (-2.13)	-21.12 (-0.56)	-67.06 (-1.07)	-18.15 (-0.30)
High-tuition private	-56.83 (-2.62)	-70.62 (-3.25)	98.90 (1.75)	-45.74 (-1.17)
Institutional type by quality interactions				
Public two-year	.054 (1.70)	- .063 (-2.72)	.069 (1.32)	.022 (0.55)
Low-tuition public four-year	.059 (4.58)	.082 (6.25)	.072 (3.47)	.048 (3.03)
High-tuition public four-year	.057 (2.88)	.088 (3.59)	.167 (4.21)	.024 (0.96)
Low-tuition private	.089 (3.78)	.052 (2.32)	.131 (2.30)	.065 (2.28)
Medium-tuition private	.091 (3.05)	.053 (1.41)	.089 (1.37)	.065 (1.01)
High-tuition private	.088 (4.66)	.098 (5.20)	- .026 (-0.54)	.081 (2.25)
R^2	.27	.27	.26	.26
F	78.9	78.2	19.5	21.1
Dep. var. standard deviation	26.52	26.07	28.14	26.18
N	2735	2828	736	810

[a]Excluded dummy is no-more-education option; T-statistic given in parentheses.

plots of the residuals. We concluded in all cases that the residuals looked fairly normal and thus that the assumptions were compatible with the data.

Income

The NLS obtained students' estimates of the category into which their family income fell. To deal with the problem posed by the open-ended category, we converted each student's income category to the percentile corresponding to the midpoint of its range in the cumulative income distribution.

We initially regressed percentile income on option types and four sets of interactions: between institutional types and cost, scholarships, loans, and work-study. We found that the coefficients of the cost-interaction terms were positive, as expected, while those of the scholarship interactions were all negative and of about the same magnitude as were the corresponding cost-interaction coefficients. This suggested that an increase in the scholarship a student would receive were he or she to attend an institution would have about the same effect on his or her choice as an equal decrease in its costs. We also found that the coefficients of the loan interaction and the work-study interaction terms were generally negative and that corresponding loan and work-study interaction coefficients were of the same order of magnitude.

There were some inconsistencies in the models: Some coefficients had the wrong sign, though all significant coefficients had the expected sign. And the precisions of the estimated coefficients, particularly those of the work-study interactions, were sometimes low. We therefore explored a more parsimonious model in which scholarships were subtracted from cost to form a net cost variable, and loans and work-study were summed to form a variable we term "aid." The results are shown in Table 3.

The coefficients of the net cost and aid interactions are generally significant, and all significant coefficients have the right sign. For any type of institution, the more (net) costly schools are attended by higher-income students. Accordingly, scholarships, by reducing net

Table 3

RESULTS OF PERCENTILE FAMILY INCOME REGRESSIONS

Variable	Student Type			
	White Male	White Female	Nonwhite Male	Nonwhite Female
Constant[a]	47.756	44.151	27.775	23.017
	(71.84)	(70.03)	(24.18)	(22.40)
Option-type dummies				
Vocational-technical	.632	1.172	1.486	- .070
	(0.26)	(0.64)	(0.30)	(-0.23)
Public two-year	4.000	3.824	8.211	-2.695
	(1.43)	(1.40)	(1.81)	(-0.72)
Low-tuition public four-year	13.226	2.156	1.197	2.886
	(5.41)	(0.83)	(0.25)	(0.79)
High-tuition public four-year	4.267	7.571	22.799	-3.29
	(0.85)	(1.56)	(3.41)	(-0.43)
Low-tuition private	11.812	2.764	7.62	2.532
	(2.51)	(0.54)	(0.64)	(0.30)
Medium-tuition private	3.481	-5.445	-11.137	9.587
	(0.45)	(-1.10)	(- 0.71)	(0.67)
High-tuition private	-4.334	-18.359	18.072	16.240
	(-0.75)	(-2.51)	(1.66)	(1.86)
Institutional type by net cost interactions				
Public two-year	.009	.010	- .003	.006
	(2.47)	(3.09)	(-0.54)	(1.52)
Low-tuition public four-year	.002	.015	.008	.011
	(1.28)	(7.47)	(2.06)	(3.52)
High-tuition public four-year	.009	.010	- .000	.017
	(3.59)	(3.94)	(- .02)	(4.10)
Low-tuition private	.005	.010	- .002	.001
	(1.87)	(3.49)	(-0.29)	(0.20)
Medium-tuition private	.007	.012	.019	.013
	(2.41)	(4.73)	(2.54)	(2.38)
High-tuition private	.010	.014	.012	.007
	(5.49)	(6.55)	(1.63)	(1.97)
Institutional type by aid interactions				
Public two-year	- .008	- .016	- .015	- .000
	(-1.62)	(-2.87)	(-1.53)	(-0.08)
Low-tuition public four-year	- .015	- .016	- .014	- .016
	(-4.33)	(-5.49)	(2.20)	(-3.85)
High-tuition public four-year	- .018	- .016	- .005	- .001
	(-3.57)	(-3.19)	(-0.52)	(-0.21)
Low-tuition private	- .018	- .014	.007	- .004
	(-2.96)	(-3.35)	(0.46)	(-0.49)
Medium-tuition private	- .004	- .006	- .028	- .012
	(-1.00)	(-1.68)	(-2.05)	(-1.17)
High-tuition private	- .123	- .003	- .014	- .017
	(-2.59)	(-1.16)	(-1.03)	(-1.95)
R^2	.11	.17	.09	.12
F	18.35	29.84	3.32	5.67
Estimated standard deviation	24.99	23.75	24.77	22.06
N	2375	2828	736	810

[a]Excluded dummy is no-more-education option; T-statistic given in parentheses.

costs, attract lower-income students to more costly schools than they would attend in the absence of the scholarships. The aid-interaction terms similarly show that loans and work-study permit institutions of each type attract more lower-income students than they would otherwise obtain.

The normal probability plots of the percentile income residuals showed approximate normality. It also appeared that the spread of the residuals was independent of the independent variables.

We also examined scatterplots of ability and percentile income residuals to see if they formed an elliptical pattern. We observed no violations and concluded that the multivariate normal assumption for ability and percentile income was reasonably consistent with the data.

Location of High School

We assume that f_3, the distribution of high school locations for students attending a particular institution, is a function of the distance between the high school and institution. To obtain normality for f_3, we transformed distance to logarithms; then, a simple model was fitted including only dummy variables for the institutional option types. Table 4 presents the results.

Marginal Probabilities

In the final step we estimate P(j), the marginal probability of a given choice. Probabilities for the no-more-education and vocational-technical options are taken to be the national proportions of high school seniors (by race and sex) who chose those options in 1972. Marginal probabilities for each institution are taken to be the national proportion of high school seniors (by race and sex) who entered all institutions of that type weighted by that institution's share (by race and sex) of total first-time enrollment among all institutions of its type.

Table 4

RESULTS OF LOG DISTANCE REGRESSIONS

Variable	Student Type			
	White Male	White Female	Nonwhite Male	Nonwhite Female
Constant[a]	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Institutional type dummies				
Public two-year	2.47	2.40	2.46	2.38
	(37.28)	(37.98)	(22.25)	(18.80)
Low-tuition public four-year	3.76	3.72	3.55	3.19
	(62.67)	(66.45)	(30.41)	(29.55)
High-tuition public four-year	4.04	4.20	4.09	3.46
	(40.86)	(49.22)	(20.66)	(18.88)
Low-tuition private	4.44	4.40	3.70	3.90
	(41.13)	(43.74)	(14.36)	(19.19)
Medium-tuition private	3.89	4.04	3.50	3.80
	(30.23)	(32.61)	(11.14)	(10.20)
High-tuition private	4.38	4.37	4.34	3.88
	(45.07)	(42.10)	(16.28)	(17.02)
R^2	.74	.76	.72	.69
F	1122.4	1289.7	267.9	250.5
Est. standard deviation	1.08	1.03	0.98	1.04
N	2735	2828	736	810

[a]Excluded dummies: no-more-education and vocational-technical options; T-statistics given in parentheses.

TESTING THE MODEL

We used the parameter estimates we obtained on the fitting sample to predict the enrollment behavior (by race and sex) of the 7022 students in the testing sample. Our model can be used to predict the distribution of students over all colleges in the country. However, the predicted probability that a student will attend any particular college rapidly declines with distance. We believed that a simulation of a student's choices among the institutions "near" his or her home would lead to reasonably accurate predictions and would be much less expensive; arbitrarily, we chose a 50-mile radius. To ensure that a nonempty simulation set was available for every student, we also included the nearest public two-year college and nearest public four-year college if they were more than 50 miles away.

We calculated the probabilities that each student would choose each option in a set comprising: no more education, vocational-technical, the nearest public two-year college (regardless of location), the nearest public four-year college (regardless of location), and each other institution of higher education within 50 miles of the student's high school. We then stratified the institutions by type, and summed the estimated probabilities over the institutions in each category. Finally, we counted the actual number of students who chose each option type, including those who attended colleges more than 50 miles away. Table 5 shows the actual and predicted frequency distributions by race and sex.

We also predicted the frequency distribution of the full sample; Table 6 compares our predictions with the actual distributions.

Table 5

ACTUAL AND PREDICTED PERCENTAGE DISTRIBUTIONS OF TEST-SAMPLE STUDENTS' POSTSECONDARY CHOICES FOR SELECTED STUDENT POPULATIONS

Student Population	Postsecondary Option										
			Public Colleges and Universities				Private Colleges and Universities				
	No More Education	Vocational-Technical School	Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	Total, All Colleges
All students											
Actual	53.2	6.1	12.1	14.0	5.0	31.1	3.5	2.1	3.9	9.5	40.6
Predicted	54.2	5.6	11.6	15.3	4.6	31.5	2.8	1.9	4.0	8.7	40.2
White males											
Actual	50.8	4.0	13.3	15.8	5.5	34.6	3.5	2.4	4.7	10.6	45.2
Predicted	52.9	4.2	12.0	16.0	4.8	32.8	2.9	2.2	5.0	10.1	42.9
White females											
Actual	51.5	8.2	11.0	13.6	5.4	30.0	3.7	2.4	4.0	10.1	40.1
Predicted	51.5	7.0	11.4	16.0	5.2	32.6	3.1	2.0	3.8	8.9	41.5
All whites											
Actual	51.2	6.1	12.1	14.7	5.5	32.3	3.6	2.4	4.4	10.4	42.7
Predicted	51.2	5.6	11.7	16.0	5.0	32.7	3.0	2.1	4.4	9.5	42.2
Nonwhite males											
Actual	62.6	3.9	14.6	10.0	3.7	28.3	2.5	0.9	1.8	5.2	33.5
Predicted	65.2	3.8	12.8	11.0	2.5	26.3	1.7	1.2	1.8	4.7	31.0
Nonwhite females											
Actual	59.5	7.8	10.0	12.7	2.4	25.1	3.7	1.1	2.8	7.6	32.7
Predicted	59.0	7.4	9.6	13.9	3.9	27.4	2.7	0.9	2.5	6.1	33.5
All nonwhites											
Actual	60.9	6.0	12.1	11.5	3.0	26.6	3.2	1.0	2.3	6.5	33.1
Predicted	61.8	5.7	11.1	12.6	3.3	27.0	3.3	1.1	2.2	6.6	33.6
All males											
Actual	53.1	4.0	13.5	14.7	5.2	33.4	3.3	2.1	4.1	9.5	42.9
Predicted	55.1	4.1	12.2	15.0	4.3	31.5	2.7	2.0	4.4	9.1	40.6
All females											
Actual	53.4	8.1	10.8	13.4	4.8	29.0	3.7	2.1	3.7	9.5	38.5
Predicted	53.2	7.1	11.0	15.5	4.9	31.4	3.0	1.8	3.5	8.3	39.7

Table 6

ACTUAL AND PREDICTED PERCENTAGE DISTRIBUTIONS OF ALL STUDENTS' POSTSECONDARY CHOICES FOR SELECTED STUDENT POPULATIONS

Student Population	Postsecondary Option										
			Public Colleges and Universities				Private Colleges and Universities				
	No More Education	Vocational-Technical School	Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	Total, All Colleges
All students											
Actual	52.3	5.7	11.8	14.4	5.4	31.6	3.6	2.4	4.3	10.3	41.9
Predicted	51.9	5.5	11.6	14.9	6.2	32.7	3.5	2.5	3.8	9.8	42.5
White males											
Actual	51.1	3.9	12.8	15.6	5.4	33.8	3.6	2.7	5.0	11.3	45.1
Predicted	50.7	4.1	12.2	15.6	6.2	34.0	3.6	2.9	4.8	11.3	45.3
White females											
Actual	50.0	7.5	11.1	14.4	6.0	31.5	3.9	2.7	4.4	11.0	42.5
Predicted	49.8	6.9	11.4	15.3	6.9	32.6	3.6	2.7	3.5	10.1	42.7
All whites											
Actual	50.6	5.7	11.9	15.0	5.7	32.6	3.7	2.7	4.7	11.1	43.7
Predicted	50.3	5.5	11.8	15.5	6.5	33.8	3.6	2.8	4.1	10.5	44.3
Nonwhite males											
Actual	62.8	3.4	13.4	10.6	4.3	28.3	2.2	1.3	1.9	5.4	33.7
Predicted	62.9	3.7	12.6	10.6	4.5	27.7	2.1	1.8	1.9	5.8	33.5
Nonwhite females											
Actual	58.8	7.9	9.5	13.1	3.4	26.0	3.4	1.0	2.9	7.3	33.3
Predicted	57.3	7.2	9.7	13.7	4.8	28.2	3.5	1.1	2.6	7.2	35.4
All nonwhites											
Actual	60.7	5.8	11.3	12.0	3.8	27.1	2.9	1.1	2.5	6.5	33.6
Predicted	59.9	5.6	11.0	12.3	4.7	28.0	2.9	1.4	2.3	6.6	34.6
All males											
Actual	53.0	3.8	12.9	14.7	5.2	32.8	3.3	2.5	4.5	10.3	43.1
Predicted	52.7	4.0	12.2	14.8	5.9	32.9	3.4	2.7	4.3	10.4	43.3
All females											
Actual	51.6	7.6	10.8	14.1	5.5	30.4	3.8	2.4	4.1	10.3	40.7
Predicted	51.1	7.0	11.1	15.0	6.5	32.6	3.6	2.4	3.3	9.3	41.9

III. THE ICF MODEL*

STRUCTURE

ICF models students' enrollment behavior as a hierarchical sequence of binary decisions. First, students decide whether they will continue their education beyond high school. Those who continue then choose between a vocational-technical school and an institution of higher education. The third stage focuses on high-ability college-going students; they decide whether or not they will attend a selective institution. Those who do not choose a selective college are recombined with the less able college-going students in the fourth stage: the choice between (nonselective) private and public institutions. Finally, the students who opt for a public school choose between two-year and four-year institutions.

Dichotomous logit maximum likelihood is used to estimate the parameters for each stage of the model. At each stage, all students not assigned to a terminal endpoint at a previous stage enter the estimation. Students are considered to be eligible to enter a selective college in the third stage if they actually enrolled at a selective institution or are in the top 10 percent of the ability distribution.

VARIABLES

Three types of explanatory variables enter the model at each stage: student characteristics, prices, and measures of the supply of post-secondary institutions.

Student Characteristics

ICF stratifies students by family income (less than $6000, $6000-$10,000, $10,000-$15,000, and $15,000 or more) and, where sample size permits, estimates separate equations at each stage for the students in each stratum. Various other student characteristics (e.g., father's education, mother's education, sex, high school grade point average)

*See Ref. 1 for further details of the ICF model.

enter each of the equations. There is no systematic pattern: Father's education enters the equations in the first three stages but not in the last two. Father's occupation--a dummy variable coded 1 if the father's occupation requires college training and 0 otherwise--appears only in the equations for the last stage. And so forth. No student characteristic appears in all stages. There is no explanation of the presence or absence of a student characteristic in any particular stage. The tables provided below show the student characteristic and other variables that ICF enters into the equations at each stage.

Prices

A "price" for each of the four collegiate options was imputed for each student. In the event that a student applied to and was accepted by an institution of a particular type, the imputed price for the corresponding option was replaced by the actual price. The equations for each stage include the prices of all collegiate options available at that or any subsequent stage.

The price of an institution is defined as tuition plus room and board (if located more than 30 miles from the student) plus $550 (allowances of $400 for personal expenses and $150 for books and supplies) plus $46.66 times its distance* (if located within 30 miles of the student) minus the present value of financial aid. The present value of financial aid is assumed to equal grant and scholarship awards, plus 30 percent of loan awards, plus either 50 percent of work-study awards (if the college is located in an SMSA) or 80 percent of work-study awards (if the college is not located in an SMSA).** We used the procedure described in Sec. III to determine the amounts of aid of each type that would be available to the student at each school.

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*The distance cost is computed on the assumptions that a student makes 350 trips to the school per year at an average rate of 30 mph with an average mileage expense of $0.08 per mile and an average opportunity cost of time of $1.60 per hour.

**ICF assumes that the subsidy component of a loan is 30 percent. The subsidy component of a work-study award, it argues, is the difference between the award and the student's expected earnings if the aid-sponsored job were not available. It assumes that awards are twice expected earnings in industrialized areas and four times expected earnings outside industrialized areas where part-time jobs are less plentiful.

The imputed price for the public two-year option is the price of the nearest public two-year college. The imputed price for the selective option is a weighted average of the prices of all selective institutions in the country, where the weights are the inverses of their distances from the student. Prices are imputed for the nonselective, private and public, four-year options as the weighted averages of the prices of all in-state institutions of the type. Each institution's weight in these cases is the probability that the student would apply to and be accepted there provided that the institution offered a degree in the student's preferred field of study (as indicated by his or her response to a question on the baseline instruments) and accepted students of his or her race and sex. Institutions not offering a degree in the student's preferred field or not enrolling students of his or her race and sex were assigned a zero weight.

Following ICF, we computed N_{ijklm}, the total number of NLS students of race i, sex j, and ability quartile k who applied to and were accepted by a public four-year (ℓ=1) or nonselective, private (ℓ=2) college of selectivity level m (m takes on six values: 0 for unknown, and 1 through 5). The probability that a student will apply to and be accepted by an institution of type l and selectivity level m is taken to be:

$$N_{ijklm} \Big/ \sum_m N_{ijklm}$$

The "Supply" of Institutions

The numbers of public two-year, public four-year, and nonselective private colleges located within 30 miles enter some of the equations.

DEVIATIONS FROM THE ICF SPECIFICATION

We deemed it appropriate to deviate from ICF's specification of their model at several points.

The ICF model includes 20 equations--for four populations at five decision points. Where sample size considerations precluded estimation of an equation, they combined it with another income group in a single equation and introduced interaction terms between income group and the price variables. Our sample allowed us to stratify by income in all but

one case. (We had to combine the two lower-income groups in the selective college equation.) We discarded the redundant income group by price interaction terms where it was possible to estimate separate equations for each income group. We followed ICF's general approach in estimating the selective equation for the two lower-income groups by entering interactions between income group and prices. We deviated from their approach by also entering a dummy variable for income group, allowing the intercept to vary across income groups.

ICF included sex in some equations, but not in others. They did not enter race in any equation. We entered sex and race in every equation.

ICF's variables included numbers of years of schooling completed by the student's father and mother. We allowed for the possibility that the influence of parental educational levels is nonlinear by entering, instead, a series of dummy variables corresponding to the response categories.

ICF used students' self-reported grade point averages as independent variables in some equations, as stratification criteria in computing the apply/accept weights for imputing public four-year and nonselective private colleges' prices, and as the criterion for inclusion in the selective college equation. In each case, we use students' ability instead.

In computing apply/accept weights, ICF neglected students' sex and race. We developed separate sets of weights for race by sex categories of students.

THE PARAMETERS

Tables 7 through 11 present the estimated parameters for the ICF model for the "fitting" subsample. Except as noted above, we used the ICF approach--estimation procedure, variables, etc.--throughout.

TESTING THE MODEL

We used the parameter estimates to estimate the probabilities that each student in the "test" sample would choose each of the six ICF post-secondary options, and summed over all students and over selected categories of students, to obtain predicted frequency distributions of

Table 7

COEFFICIENTS FOR THE ICF MODEL: NO-MORE-EDUCATION EQUATION[a]

Variable	Income Level			
	<$6,000	$6,000-$9,999	$10,000-$14,999	≥$15,000
Private nonselective price	- .001	- .000	- .000	- .000
Public two-year price	- .001	- .0004	- .001	- .001
Public four-year price	- .001	- .0013	- .001	- .001
Student knowledge of financial aid sources[b]	- .021	.0040	- .002	.015
No. of nearby public two-year[c]	.028	.0026	- .022	.008
No. of nearby public four-year[c]	- .021	.0041	- .015	.041
Ability	.021	.0182	.019	.020
Academic track	.810	1.185	1.089	1.231
Vocational track	- .359	- .370	- .280	- .795
Sex male	.258	.177	.246	.349
Race nonwhite	.449	.292	- .039	.213
Father's education:				
High school graduate	.111	.234	.082	.381
Some college	.242	.222	.263	.359
College graduate	.090	- .026	.312	.619
Postgraduate degree	- .674	.165	.401	.458
Unknown	- .328	-2.004	.0365	1.409
Mother's education:				
High school graduate	.143	.234	.552	.460
Some college	.285	.525	.699	.773
College graduate	1.389	.937	1.061	1.083
Postgraduate degree	1.172	.431	.504	.540
Unknown	.941	.733	.001	-7.559
Constant[d]	-1.031	-1.649	-2.482	-3.376
No. of observations	1204	2613	1853	1439

[a]Dependent variable = 1 if student continues education beyond high school; 0, otherwise.

[b]Number of programs (of 18) to which student responded "yes" or "no" when asked if he or she intended to use as source of support for post-secondary education. Possible answers to questions were "yes," "no," and "not familiar with program."

[c]Number of institutions located within 30 miles.

[d]Excluded dummies: general high school track, sex female, race white, father's education less than high school graduate, mother's education less than high school graduate.

Table 8

COEFFICIENTS FOR THE ICF MODEL: VOCATIONAL-TECHNICAL EDUCATION VERSUS HIGHER EDUCATION EQUATION[a]

Variable	Income Level			
	<$6,000	$6,000-$9,999	$10,000-$14,999	≥$15,000
Private nonselective price	.000	.000	.000	- .000
Public two-year price	- .000	- .000	.000	- .001
Public four-year price	.001	.001	.001	.000
Student knowledge of financial aid sources[b]	- .030	- .016	.006	.059
No. of nearby public two-year[c]	- .294	- .085	- .155	- .097
No. of nearby public four-year[c]	.120	.043	.107	.116
Ability	- .026	- .016	- .020	- .0186
Academic track	-1.145	- .458	- .676	- .805
Vocational track	.116	.608	.846	.912
Sex male	.908	.560	.609	- .019
Race nonwhite	-1.085	- .616	- .823	- .048
Father's education:				
High school graduate	- .344	- .474	. -528	- .387911
Some college	.300	- .878	- .730	-1.51108
College graduate	.134	- .273	-2.339	-1.59263
Postgraduate degree	-2.604	- .431	-1.511	-1.71379
Unknown	-2.131	-5.359	6.865	.000000
Mother's education:				
High school graduate	- .367	.010	- .002	- .427531
Some college	- .228	.015	- .088	- .299
College graduate	-1.575	- .330	- .232	- .527
Postgraduate degree	1.153	- .489	.172	- .795
Unknown	3.956	6.711	.000	.000
Constant[d]	2.216	.041	.882	2.439
No. of observations	418	1009	952	971

[a]Dependent variable = 1 if student continues education beyond high school; 0, otherwise.

[b]Number of programs (of 18) to which student responded "yes" or "no" when asked if he or she intended to use as source of support for post-secondary education. Possible answers to questions were "yes," "no," and "not familiar with program."

[c]Number of institutions located within 30 miles.

[d]Excluded dummies: general high school track, sex female, race white, father's education less than high school graduate, mother's education less than high school graduate.

Table 9

COEFFICIENTS FOR THE ICF MODEL: SELECTIVE PRIVATE VERSUS OTHER HIGHER EDUCATION EQUATION[a]

Variable	Income Level		
	<$10,000	$10,000-$14,999	≥$15,000
Prices:			
Private nonselective	.001	.001	.000
Selective	- .002	- .001	- .001
Public four-year	.004	.001	.000
Sex male	.408	- .115	- .305
Race nonwhite	2.531	- .429	.185
No. of siblings at home	- .088	.015	.0187
No. of siblings at home unknown	10.543	- .980	-6.863
Income $6,000-$10,000	4.984	.000	.000
Prices interactions:[b]			
Private nonselective	- .001	.000	.000
Selective	.000	.000	.000
Public four-year	- .003	.000	.000
Father's education:			
High school graduate	- 1.200	.880	.516
Some college	- .248	1.388	.052
College graduate	- 2.251	1.284	.221
Postgraduate degree	- .419	1.962	1.057
Unknown	2.297	.000	.000
Constant[c]	- 2.685	- .564	1.349
No. of observations	165	192	289

[a]Dependent variable = 1 if student attended selective college; 0, otherwise.

[b]Referenced price interacted with income $6,000-$10,000 dummy.

[c]Excluded dummies are: sex female, race white, income less than $6,000, and father's education less than high school graduate.

Table 10

COEFFICIENTS FOR THE ICF MODEL: PRIVATE NONSELECTIVE VERSUS PUBLIC COLLEGE EQUATION[a]

Variable	Income Level			
	<$6,000	$6,000-$9,999	$10,000-$14,999	≥$15,000
Price:				
Private nonselective	- .002	- .002	- .002	-.000
Public two-year	.001	- .000	.001	-.001
Public four-year	.001	.001	.001	.000
No. of nearby public two-year	- .109	- .083	- .124	-.081
No. of nearby public four-year	.266	- .061	.045	.032
No. of nearby private nonselective	- .001	.051	.029	.027
Ability squared	- .000	- .000	.000	.000
Ability interacted with public two-year price	- .000	- .000	- .000	-.000
No. of siblings in college	- .099	- .020	.003	-.160
No. of siblings at home	- .099	- .036	.074	.052
Race nonwhite	- .832	- .570	- .714	-.882
Sex male	.212	.244	- .172	-.255
Constant[b]	1.564	1.331	1.023	-.199
No. of observations	323	804	789	809

[a]Dependent variable = 1 if student attended a private nonselective college; 0, otherwise.

[b]Excluded dummies are: number of siblings in college unknown, number of siblings at home unknown, race white, and sex female.

Table 11

COEFFICIENTS FOR THE ICF MODEL: PUBLIC FOUR-YEAR VERSUS PUBLIC TWO-YEAR EQUATION[a]

Variable	Income Level			
	<$6,000	$6,000-$9,999	$10,000-$14,999	≥$15,000
Price:				
Public two-year	- .003	- .002	- .004	- .005
Public four-year	- .002	- .003	- .002	- .002
Student knowledge of financial aid sources[b]	- .046	.017	.025	.004
Ability interacted with public two-year price	.000	.000	.000	.000
Father's occupation[c]	.626	- .017	.273	.142
No. of nearby public two-year	- .070	- .166	- .101	- .092
No. of nearby public four-year	.093	.311	.155	.163
Race nonwhite	1.142	.175	.763	1.084
Sex male[d]	- .242	- .078	.416	.309
Constant	1.353	2.814	1.574	2.219
No. of observations	263	652	626	620

[a]Dependent variable = if student attended a public four-year college; 0, otherwise.

[b]Number of programs (of 18) to which student responded "yes" or "no" when asked if he or she intended to use as source of support for postsecondary education. Possible answers to questions were "yes," "no," and "not familiar with program."

[c]Dummy variable coded 1 if father's occupation requires a college degree; 0, otherwise.

[d]Excluded dummies are: father's occupation requires less education than a college degree, race white, and sex female.

the students over the options. We also computed the corresponding actual frequency distributions over the options. Table 12 shows the actual distributions of "test" sample students, the ICF predicted distributions, and, for comparison purposes, the corresponding predicted frequency distributions we obtained by using the Rand model.* We also show, for each predicted distribution, the sum of the absolute values of the differences between the predicted and actual frequencies (the Gini Coefficient); higher values imply greater discrepancies between the predicted and actual distributions.

It should be noted that we did not use ICF's simulation approach. They have simulated the choice probabilities of a sample of students in an income group using the mean values of the students' characteristics and the supply variables, and estimates of the average student budget at each of the four types of institutions as the price variables. This procedure yields an estimate of the geometric mean (which is, in general, less than and, at most, equal to the arithmetic mean) of the choice probabilities. The procedure also entirely neglects the facts that there are critical differences among students in terms of the accessibility of various postsecondary options and that these differences influence their choices.

We used each student's characteristic, supply, and price variables, calculated according to the ICF specifications, to estimate his or her choice probabilities and summed to obtain the aggregate predicted distribution.

COMPARING THE RAND AND ICF MODELS

Table 12 shows that the Rand model generally yields more accurate predictions than does the ICF model. Its accuracy is superior for all

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*One of the important features of the Bayesian approach is that student choice probabilities are calculated for individual institutions. These may then be aggregated in any desired manner. In particular, it is not necessary to aggregate the predicted distribution of student choice probabilities over the institutional types used in estimating the model's parameters. Thus, we could sum our predictions for the test sample students over the postsecondary enrollment categories used by the Inner City Fund.

Table 12

COMPARISON OF ICF MODEL AND RAND MODEL PREDICTIONS: PERCENTAGE DISTRIBUTIONS OF STUDENTS OVER ICF OPTION CATEGORIES, FOR SELECTED STUDENT POPULATIONS

Student Population	Distribution per ICF Option Category						Gini Coefficient
	No More Education	Vocational-Technical	Selective	Nonselective Private	Public Four-Year	Public Two-Year	
All students							
Actual	53.2	6.1	3.2	7.6	18.0	12.0	
ICF	55.7	5.7	2.0	6.6	17.2	12.9	6.8
Rand	54.2	5.6	4.0	5.8	18.8	11.5	5.4
White males							
Actual	50.8	4.0	3.9	8.1	20.0	13.1	
ICF	54.1	4.2	2.5	7.9	17.4	14.0	8.7
Rand	52.9	4.2	5.3	6.4	19.2	12.0	7.3
White females							
Actual	51.5	8.2	2.9	8.3	18.2	10.9	
ICF	52.2	7.2	2.1	6.9	19.3	12.3	6.4
Rand	51.5	7.0	3.6	6.3	20.3	11.3	6.4
All whites							
Actual	51.2	6.1	3.4	8.2	19.1	12.0	
ICF	53.1	5.7	2.3	7.4	18.3	13.1	6.3
Rand	52.2	5.6	4.4	6.3	19.8	11.7	5.4
Nonwhite males							
Actual	62.6	3.9	1.2	4.5	13.3	14.6	
ICF	67.6	3.9	0.4	3.6	12.8	11.7	10.0
Rand	65.2	3.8	2.3	3.2	12.8	12.8	7.2
Nonwhite females							
Actual	59.5	7.8	2.9	5.7	14.0	10.0	
ICF	63.6	7.2	1.0	3.6	12.8	11.9	11.9
Rand	59.0	7.4	2.9	4.3	16.9	9.6	5.7
All nonwhites							
Actual	60.9	6.0	2.1	5.2	13.7	12.1	
ICF	65.4	5.7	0.7	3.6	12.8	11.8	9.0
Rand	61.8	5.7	2.6	3.8	15.1	11.0	5.4
All males							
Actual	53.1	4.0	3.4	7.4	18.7	13.4	
ICF	56.7	4.1	2.1	7.0	16.5	13.6	7.8
Rand	55.3	4.1	4.7	5.8	18.0	12.1	7.3
All females							
Actual	53.4	8.1	2.9	7.7	17.2	10.7	
ICF	54.8	7.2	1.8	6.1	17.8	12.2	7.1
Rand	53.2	7.1	3.4	5.9	19.5	10.9	6.0
Income <$6,000							
Actual	66.6	7.2	1.4	3.4	11.5	9.9	
ICF	71.0	6.5	0.4	2.8	8.3	11.0	11.1
Rand	71.3	7.0	0.9	2.1	9.8	8.9	9.4
Income $6,000-$9,999							
Actual	60.6	7.1	1.5	5.2	13.7	11.9	
ICF	63.5	6.7	0.6	4.3	13.1	11.8	5.8
Rand	63.8	6.5	1.9	3.6	14.0	10.2	7.7
Income $10,000-$14,999							
Actual	50.8	5.8	2.3	8.7	20.3	12.0	
ICF	51.1	5.9	1.5	6.8	19.3	15.4	7.4
Rand	47.8	5.2	4.6	6.9	22.3	13.2	10.8
Income >$15,000							
Actual	31.1	3.6	8.7	14.2	28.4	14.0	
ICF	34.2	3.0	6.4	13.7	29.6	13.2	8.6
Rand	30.2	3.3	10.0	11.7	30.7	14.0	7.2
Lowest ability quartile							
Actual	76.5	7.4	0.2	2.2	5.1	8.6	
ICF	80.3	6.2	0.0	2.2	3.9	7.4	7.6
Rand	78.5	6.1	0.2	1.9	5.3	8.0	4.5
Third ability quartile							
Actual	65.1	7.0	0.6	4.6	10.3	12.3	
ICF	67.4	6.6	0.0	4.6	9.5	11.9	4.5
Rand	66.1	6.4	0.9	3.9	11.4	11.3	4.6
Second ability quartile							
Actual	46.3	5.9	1.5	8.7	21.5	16.1	
ICF	48.7	5.9	0.0	8.2	20.9	16.3	5.3
Rand	48.2	6.0	3.5	7.0	21.4	14.0	7.9
Highest ability quartile							
Actual	25.3	4.0	10.3	14.6	34.7	11.0	
ICF	26.9	4.0	7.9	11.3	34.1	15.8	12.8
Rand	24.5	4.1	11.5	10.4	36.7	12.8	10.2

students and for 12 of the 16 subgroups of students.

The Rand model also yields estimates of the effects of alternative policies at much less expense. A simulation of a single policy alternative for the full sample (14,131 students) was accomplished in about 550 CPU seconds (on an IBM 370/158). Using the ICF model to perform the same simulation required just over 4500 CPU seconds.

Finally, the Rand model provides vastly more flexibility. Because the results of a simulation are obtained on an institution-by-institution basis, they can be aggregated as desired to show the likely consequences of an alternative for any class of institutions. It thus serves the needs of policymakers concerned with the effects of a policy on any particular type of institution, and can readily accommodate policy concerns as they emerge or evolve over time. The ICF approach provides choice probabilities by class of institution. There is no way the results can be used to examine the implications of a policy for a class of institutions other than those that are the terminal outcomes of the model.

Suppose, for example, one wished to use the ICF model to examine the consequences of a policy for low-cost private institutions. It would be necessary to compute four additional price variables--for nonselective low-cost and high-cost private institutions and for selective public and private institutions--for each student (an expensive process in itself) and, at a minimum, estimate two additional equations--for the choice between these low-cost and high-cost private institutions, and for the choice between public and private selective institutions.* The selective public/private equation could then be used to estimate the probability that a student who chooses the selective option will choose a private school. The low-cost/high-cost equation could then be used to examine the choices made by selective-private goers and by nonselective-private goers. Consistency might also demand that the go/no-go, vocational-technical/collegiate, selective/nonselective, and public/nonselective/private

*The iterative process used to estimate the equations is also an expensive procedure. The 19 ICF submodels we estimated required an average of 5 passes each before an acceptable level of convergence was obtained. We estimate that about 7000 CPU seconds on an IBM 370/158 would be needed to reestimate the models for a different set of institutional classes.

equations be reestimated, using the new price variables rather than those which previously entered the equations.

And, after all this, if one wanted to consider a somewhat different definition of "low-cost" private, the whole process would have to be done over again.

IV. THE EFFECTS OF ALTERNATIVE FINANCIAL AID POLICIES

This section presents estimates of the enrollment distribution that the ten BEOG policies would engender. We begin with a brief summary of the simulation procedures; details of these procedures are relegated to App. B. The ten policies are then described. We present the simulation results for all students and for subgroups of students, stratified by sex, race, and income. Finally, we contrast the various implications in terms of their relative effects on enrollment distributions.

The simulation results should be interpreted as indicators of the directions and rough orders of magnitude of the enrollment rates and patterns likely to be engendered by BEOG award rules. They do not pretend to be precise forecasts. The results are conditional on the point estimates reported in Sec. II; time and resources were not sufficient to undertake sensitivity analyses for alternative parameter values. Future cohorts of high school seniors may not exhibit the same enrollment behavior as that of the NLS students. High school seniors may not be aware of the BEOG award rules and the implications of those rules for themselves. Finally, the model and its results assume that institutions and states do not adapt their financial aid programs and other policies to BEOG award rules.

SIMULATION PROCEDURES

A BEOG policy's effects are simulated in several steps. We begin by estimating students' family contributions and constructing, for each student, a representative set of postsecondary options. We then use the model to estimate the probability that he or she will choose each postsecondary option. The results are weighted and summed over categories of options to obtain a "baseline" estimate of the national distribution of students' postsecondary choices (shown earlier in Table 6). Using the BEOG policy to estimate the awards each student would receive from the institutions in his representative set, we use the model to compute the change in the probability that he or she will choose each option. Finally, we weight and sum the revised probabilities to obtain an estimate of the national distribution of

students' postsecondary choices, given the hypothesized BEOG award policy.

THE POLICIES

Among the ten BEOG policies, five retain the existing award rules, varying the award parameters; one is a scheduled reduction alternative; and four pertain to proposed changes in the award rules themselves. The ten policies were selected by officials of the Office of the Assistant Secretary for Planning and Evaluation, Department of Health, Education, and Welfare.

Policies 1 to 5: Alternative Award Parameters

The first five alternatives provide that a student's award at a particular institution will be the:

lesser of { a ceiling less his family contribution,
a percentage of the cost of attending the institution, or
a percentage of the student's need,

provided that the grant exceeds a minimum. The specific award parameters considered in the simulations are as follows:

Policy Alternative	Ceiling	Percentage of Cost	Percentage of Need	Minimum
1	$1400	50	100	$200
2	1400	100	50	200
3	1400	100	100	200
4	2000	100	50	200
5	1800	50	100	200

Policy 6: A Scheduled Reduction Alternative

If the BEOG appropriation is not sufficient to fully fund the program, a "scheduled reduction" is imposed. In this procedure, each student's personal maximum (the ceiling less his or her family contribution) is scaled down to a percentage of its original value according to the following schedule:

75 percent if the original personal maximum is over $1000,
70 percent if it is from $800 to $1000,
65 percent if it is from $600 to $800, and
50 percent if it is $600 or less.

The student's grant is then the minimum of: his or her revised personal maximum, the percentage of cost, or the percentage of need, provided that the minimum exceeds $200.

If, at the scheduled reduction levels, the BEOG appropriation is more than sufficient to meet students' entitlements, an "effective ceiling" is established. All grants are uniformly scaled upward until the maximum possible grant reaches the effective ceiling.* Note that some students might actually receive larger grants under the scheduled reduction/effective ceiling rules than they would have received had the program been fully funded.

The sixth policy alternative, examined below, is a scheduled reduction with award parameters: $1800 ceiling, half cost, full need, $200 minimum, and an effective ceiling of $1400.

Policy 7: A Greater Tuition Sensitivity Alternative

The seventh policy is a set of award rules designed to make grants more sensitive to tuition levels. In this policy, a student's grant is the:

$$\text{greater of} \begin{cases} 1/2\ (\text{need} - \$1200), \\ \text{lesser of} \begin{cases} \$1800 - \text{family contribution}, \\ 1/2\ \text{need}, \end{cases} \end{cases}$$

subject to a $200 minimum.

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*Suppose, for example, that the ceiling was $1800 and a scheduled reduction with an effective ceiling of $1400 is imposed. The largest possible personal maximum would be that of a student whose family contribution is zero. According to the reduction schedule, the student's revised personal maximum would be $1350 ($1800 x .75) and, since no student can receive a grant in excess of the personal maximum, that is the maximum possible grant, given the scheduled reduction. The grant would have to be increased by 3.7 percent to bring it up to $1400. Thus, the "effective ceiling" provision would require that all grants be increased by 3.7 percent.

Policy 8: The COFHE Proposal

The Consortium on Financing Higher Education (COFHE) proposed that a student's grant comprise two awards. The first, to defray noninstructional costs such as room and board, personal expenses, etc., would be $1400 minus the family contribution. To this would be added a second award, to defray instructional costs (tuition, books and supplies, etc.), equal to the:

$$\text{lesser of} \begin{cases} \$1500 \\ 1/2\ [\text{instructional costs} - \$1200 - (\text{family contribution} - \$1400)] \end{cases}$$

A minimum grant of $200 is also imposed.

Policy 9: The Quie Proposal

Representative Quie has proposed a plan whereby a student's grant would be 50 percent of his or her need for costs up to $2400 plus 25 percent of his or her need for costs between $2401 and $4000. A student whose family contribution is $1000, for example, would receive a grant of $600 at a school costing $2200 or a grant of $900 at a school costing $3200.

Policy 10: Proportional Need Sharing

Finally, the tenth policy provides that a student's grant be 35 percent of need, subject to a $200 minimum.

THE RESULTS

We estimated the probability that each student would choose no more education, a vocational-technical school, and each institution in his or her representative set. We added the probabilities of choosing the noncollegiate options: no more education and a vocational-technical school. The institutional probabilities were summed over the institutions in each of six categories: (1) public two-year; (2) low-tuition ($465 or less) and (3) high-tuition (greater than $465) public four-year; (4) low- ($1210 or less), (5) medium- (between $1210 and $1725), and

(6) high-tuition (greater than $1725) private. The estimates were then weighted (for the student's representation in the national population) and summed over all students as well as selected subgroups to obtain the projected national distribution of the students across seven categories of postsecondary options (no college and the six collegiate categories). In each case--baseline, as well as these ten policy alternatives--we impute student grants at each institution as described in App. B.

For each policy alternative, we compute the percentage change (from the base case) in the number of students choosing each option category. The results are presented in this form below. The estimated distributions themselves appear in App. C.

Results For All Students

Table 13 shows our estimates of the percentage changes in the national numbers of students choosing each of seven categories of postsecondary options for each of the ten policies. The various policies would stimulate 3 to 5 percent increases in the numbers of these students going on to colleges and universities. With high school graduates expected to number about 3.15 million annually in the late 1970s, this means that between 40 and 60 thousand more high school graduates would go on to college each year.

It appears that the fourth policy (current BEOG award rules with a $2000 ceiling and half need) and the sixth (scheduled reduction with an $1800 ceiling, half cost, and an effective ceiling of $1400) would have the greatest effects on *total* collegiate enrollments. The fourth policy would have a relatively large (but not the largest) effect on the numbers of high school seniors enrolling in private institutions: an increase of over 8 percent. The effect of the sixth policy is largely concentrated in the public sector, where it is substantially more effective than any of the other policies. The reason for this difference is that the fourth policy's high ceiling permits large grants to students whose need is great. The sixth policy allows a much smaller maximum grant ($1400) and, as noted earlier, the scheduled reduction reduces the grants of students who choose colleges where their need is large (i.e.,

Table 13

ESTIMATED PERCENTAGE CHANGES IN THE NUMBERS OF ALL STUDENTS CHOOSING POSTSECONDARY OPTIONS UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
		Public Colleges and Universities				Private Colleges and Universities				
	Noncollege	Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	Total, All Colleges
1	-2.3	2.6	3.4	3.2	3.1	0	4.0	5.3	3.1	3.1
2	-2.3	2.6	3.4	3.2	3.1	0	4.0	5.3	3.1	3.1
3	-2.6	3.5	4.0	3.2	3.7	0	4.0	5.3	3.1	3.5
4	-3.0	2.6	3.4	6.5	3.7	2.9	12.0	10.5	8.2	4.7
5	-2.8	3.5	3.4	4.8	3.7	2.9	8.0	7.9	6.1	4.2
6	-3.3	4.3	4.7	4.8	4.6	2.9	8.0	5.3	5.1	4.7
7	-3.0	2.6	2.7	4.8	3.1	2.9	12.0	13.2	9.2	4.5
8	-3.0	3.5	2.7	3.2	3.1	0	8.0	13.2	7.1	4.0
9	-3.3	1.7	2.7	6.5	3.1	2.9	12.0	13.2	9.2	4.5
10	-2.4	1.7	2.0	4.8	2.5	2.9	8.0	13.2	8.2	3.8

where the personal maximum constraint is binding) and actually increases the grants to those who choose a college where their need is small (i.e., where the need constraint is binding and the change in the personal maximum constraint caused by the scheduled reduction has no effect on the size of the grant).

The seventh policy (Greater Tuition Sensitivity) and the ninth (Quie's Proposal) have the greatest effect on private sector enrollments, followed by the fourth and tenth policies (Proportional Need Sharing). These policies increase the numbers of high school graduates who would enroll in private institutions by 8 to over 9 percent. The first, second, and third policies (the less generous versions of the current award rules) have the least effect on private enrollment: about a 3 percent increase in each case.

As noted above, the Scheduled Reduction (sixth) policy would have the greatest influence on public sector enrollments, followed by the third, fourth, and fifth, which would stimulate an increase of about 3.7 percent. The tenth policy would have the smallest effect: an increase of about 2.5 percent.

Results By Sex and Race

Tables 14 and 15 present estimates of the percentage changes in the national distributions of students by race (white or nonwhite) and sex for the ten policies. In terms of the total change in enrollment behavior, women are much more responsive than men. The various policies would stimulate 4 to 6 percent increases in the numbers of female high school graduates, both white and nonwhite, who would enroll at a college or university. For white males, the corresponding increase would be 2 to 3 percent, and for nonwhite males, only 1/2 to 1-1/2 percent.

Note that in the case of nonwhite males there are very substantial shifts in the distributions of college-going students among the institutional categories. The numbers of nonwhite males going on to public two-year colleges actually decline by 3 to 6 percent, while the numbers going on to low-tuition, public, four-year schools increase by 7-1/2 to over 10 percent. Further, while the numbers of these students going on to public institutions of all kinds are virtually unchanged by

Table 14

ESTIMATED PERCENTAGE CHANGES IN THE NUMBERS OF WHITE STUDENTS CHOOSING POSTSECONDARY OPTIONS UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
	Noncollege	Public Colleges and Universities				Private Colleges and Universities				Total, All Colleges
		Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	
					A. White Males					
1	-1.6	3.3	0	3.2	1.8	2.8	0	2.1	1.8	1.8
2	-1.6	3.3	0	3.2	1.8	2.8	0	2.1	1.8	1.8
3	-1.8	4.1	0	3.2	2.1	2.8	0	2.1	1.8	2.0
4	-2.4	3.3	-0.6	4.8	1.8	2.8	3.5	6.3	4.4	2.4
5	-2.4	4.1	-0.6	4.8	2.1	2.8	3.5	4.2	3.5	2.4
6	-2.4	4.9	-0.6	4.8	2.4	2.8	3.5	4.2	3.5	2.7
7	-2.4	2.5	-1.3	4.8	1.2	2.8	3.5	10.4	6.2	2.4
8	-2.4	3.3	-1.3	3.2	1.2	2.8	3.5	10.4	6.2	2.4
9	-2.6	2.5	-1.3	6.5	1.5	2.8	6.9	10.4	7.1	2.9
10	-1.8	1.6	-0.6	4.8	1.2	2.8	3.5	8.3	5.3	2.2
					B. White Females					
1	-3.4	2.6	5.2	2.9	3.9	5.6	3.7	2.9	4.1	3.9
2	-3.4	2.6	5.2	2.9	3.9	5.6	3.7	5.7	5.1	4.2
3	-3.7	4.4	5.9	2.9	4.8	5.6	3.7	2.9	4.1	4.6
4	-6.2	1.8	5.9	4.4	4.2	8.3	11.1	11.4	10.2	5.5
5	-6.2	3.5	6.5	4.4	5.1	5.6	7.4	8.6	7.1	5.5
6	-6.5	4.4	7.8	4.4	6.0	5.6	7.4	2.9	6.1	6.0
7	-6.2	1.8	5.2	4.4	3.9	5.6	11.1	17.1	11.2	5.5
8	-6.2	3.5	5.2	2.9	4.2	5.6	11.1	17.1	11.2	5.8
9	-6.4	1.8	5.9	5.8	4.5	8.3	11.1	14.3	11.2	6.0
10	-3.5	0.9	3.9	4.4	3.0	3.8	11.1	14.3	10.2	4.6

Table 15

ESTIMATED PERCENTAGE CHANGES IN THE NUMBERS OF NONWHITE STUDENTS CHOOSING POSTSECONDARY OPTIONS UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
		Public Colleges and Universities				Private Colleges and Universities				
	Noncollege	Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	Total, All Colleges
				A. Nonwhite Males						
1	-0.6	-4.8	7.6	-2.2	0.4	-4.8	5.6	5.3	1.7	0.6
2	-0.6	-4.8	7.6	-2.2	0.4	-4.8	5.6	15.8	5.2	1.2
3	-0.6	-6.4	9.4	-2.2	0.4	-4.8	5.6	5.3	1.7	0.6
4	-0.8	-4.8	7.6	-2.2	0.4	-4.8	11.1	10.5	5.2	1.2
5	-0.8	-4.8	7.6	-2.2	0.4	-4.8	5.6	10.5	3.5	0.9
6	-0.8	-6.4	10.4	-2.2	0.7	-4.8	5.6	10.5	3.5	1.2
7	-0.8	-4.8	7.6	-2.2	0.4	-4.8	11.1	15.8	6.9	1.5
8	-0.8	-6.4	8.5	-2.2	0	-4.8	11.1	15.8	6.9	1.2
9	-0.8	-4.8	6.6	-2.2	0	-4.8	5.6	15.8	5.2	0.9
10	-0.8	-3.2	4.8	-2.2	0	-4.8	5.6	15.8	5.2	0.9
				B. Nonwhite Females						
1	-2.6	1.0	8.0	12.5	6.4	-8.6	9.1	7.7	0	5.1
2	-2.6	1.0	8.0	12.5	6.4	-8.6	9.1	7.7	0	5.1
3	-3.3	2.1	9.5	12.5	7.5	-8.6	9.1	7.7	0	5.9
4	-2.6	0	6.6	14.6	5.7	-8.6	18.2	11.5	2.8	5.1
5	-2.6	0	6.6	14.6	5.7	-8.6	18.2	11.5	2.8	5.1
6	-3.4	1.0	9.5	16.7	7.8	-11.4	18.2	7.7	0	6.2
7	-2.6	0	6.6	16.7	6.0	-8.6	18.2	11.5	2.8	5.4
8	-3.4	2.1	8.8	14.7	7.5	-11.4	18.2	11.5	1.4	6.2
9	-2.6	0	6.6	14.7	5.7	-8.6	18.2	11.5	2.8	5.1
10	-2.2	0	5.1	12.5	4.6	-8.6	9.1	11.5	1.4	4.0

the policy alternatives, the share of the private sector grows by 2 to 7 percent. It appears that the BEOG policies considered here do little to attract nonwhite males into higher education. Rather, their primary effect is to make it possible for the students who would have gone on to college in any event to enter more costly institutions.

White males exhibit a similar, but less dramatic, pattern of shifts from public two-year colleges to private institutions.

Results By Income Level

The ten policies are need-based in the sense that, other things being equal, a student's grant declines as the family income increases. The minimum grant constraint further concentrates the effects of the policies on low-income students by truncating the small grants that would otherwise be available to higher-income students. Table 16 shows the estimated percentage changes in the national distributions of students whose family incomes are less than $10,000, for the ten policies.

As can be seen in Table 16A, all of the policies strongly influence low-income students' college-going and college-choosing behavior. The number of low-income high school graduates going on to college increases by 18 to 33 percent. Both the public and the private sector gain low-income students, though the former generally does less well--increases of 14 to 32 percent for the various policies--than the latter. The policies increase the numbers of low-income high school graduates going on to private colleges and universities by between 25 and 53 percent.*

Table 16B shows the percentage changes in the distributions for students whose family incomes are between $6000 and $10,000. Here we find that the various alternatives stimulate increases of 5-1/2 to 10-1/2 percent in total collegiate enrollments by lower-middle-income students. The increase for the public sector ranges from 3 to 7 percent,

*The large percentage increases in the numbers of low-income students enrolling in private institutions under the policies reflects the very small numbers of such students who would do so in the absence of BEOGs. A very small increase in the numbers of low-income students enrolling in private colleges and universities translates into a large percentage change in the private sector's share of the low-income student population.

Table 16

ESTIMATED PERCENTAGE CHANGES IN THE NUMBERS OF LOW-INCOME AND LOWER-MIDDLE-INCOME STUDENTS CHOOSING POSTSECONDARY OPTIONS UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
	Noncollege	Public Colleges and Universities				Private Colleges and Universities				Total, All Colleges
		Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	
				A. Low-Income Students[a]						
1	-7.0	13.5	27.9	47.1	22.9	4.6	100.0	66.7	28.1	23.7
2	-7.0	13.5	27.9	47.1	22.9	4.6	100.0	66.7	28.1	23.7
3	-8.1	20.2	33.7	47.1	28.7	0	100.0	66.7	25.0	28.1
4	-7.5	12.4	25.6	52.9	21.9	4.6	175.0	133.3	50.0	25.9
5	-7.5	13.5	26.7	52.9	22.9	4.6	150.0	116.7	43.8	25.9
6	-9.5	20.2	38.4	58.8	31.8	4.6	150.0	100.0	40.6	33.0
7	-7.4	12.4	25.6	52.6	21.9	4.6	150.0	133.3	46.9	25.5
8	-8.6	19.1	30.2	47.1	26.6	0	150.0	183.3	53.1	30.4
9	-7.4	12.4	25.6	52.9	21.9	4.6	150.0	150.0	50.0	25.9
10	-5.3	7.9	16.3	35.3	14.1	0	125.0	133.3	40.6	17.9
				B. Lower-Middle-Income Students[b]						
1	-2.6	3.9	4.6	7.9	4.8	4.0	7.7	18.8	9.3	5.6
2	-2.6	3.9	4.6	7.9	4.8	4.0	15.4	18.8	11.1	5.9
3	-2.7	4.9	5.5	7.9	5.6	4.0	7.7	18.8	9.3	6.2
4	-4.0	3.9	5.5	15.8	6.4	8.0	30.8	37.5	22.2	9.2
5	-4.0	5.8	6.4	13.2	7.2	8.0	23.1	31.3	18.5	9.2
6	-3.7	6.8	6.4	10.5	7.2	8.0	15.4	25.0	14.8	8.5
7	-2.6	2.9	3.6	13.2	4.8	4.0	30.8	62.5	27.8	8.9
8	-3.5	3.9	2.7	7.9	4.0	4.0	30.8	62.5	27.8	8.2
9	-4.5	2.9	4.9	18.4	6.0	8.0	38.5	62.5	31.5	10.5
10	-4.8	1.0	1.8	13.2	3.2	4.0	30.8	62.5	27.8	7.5

[a]Family income $6,000 or less.

[b]Family income between $6,000 and $10,000.

and for the private sector, between 9 and 31 percent. Overall, it appears that the various policies exert 3 to 4 times as large an effect on low-income students (measured in terms of the increased percentages of students going on to public, private, and all colleges) as they do on lower-middle-income students.

The effects of the policies on students whose family incomes exceed $10,000 are negligible and are not shown.

Results By Ability

We divided the NLS students into four ability quartiles and estimated the percentage changes in the distributions for the students in each quartile. Table 17 presents the results. The policies have relatively little effect on high-ability students--2 to 3 percent increases in the numbers of such students going on to college--mainly because the enrollment rate of high-ability students in the absence of BEOGs is so large (about 73 percent*) that there is little room for improvement. Conversely, low-ability students would have the lowest enrollment rates in the absence of BEOGs--about 16 percent**--and exhibit a greater response to the policy alternatives than do the students in the upper three-quarters of the ability distribution. The pattern is continued by the students in the center of the ability distribution, where upper-middle-ability students have a lower non-BEOG enrollment rate--47 percent***--and are more responsive to the policies than are the high-ability students. Lower-middle-ability students have a still lower non-BEOG enrollment rate--29 percent****--and are even more responsive.

CONTRASTING THE POLICY ALTERNATIVES

Table 18A summarizes the relative effects of the policies on the numbers of high school graduates of various types who would go on to college. It shows the ranking of each policy, from first (greatest

*See Table C.5.

**Ibid.

***Ibid.

****Ibid.

Table 17

ESTIMATED PERCENTAGE CHANGES IN THE NUMBERS OF STUDENTS AT VARIOUS ABILITY LEVELS CHOOSING POSTSECONDARY OPTIONS UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
	Noncollege	Public Colleges and Universities				Private Colleges and Universities				Total, All Colleges
		Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	
A. Highest Ability Quartile										
1	-5.1	1.6	1.4	2.8	1.8	1.9	5.0	4.7	3.9	2.3
2	-5.1	1.6	1.4	2.8	1.8	1.9	5.0	4.7	3.9	2.3
3	-5.5	2.4	1.8	2.8	2.2	1.9	5.0	4.7	3.9	2.6
4	-7.3	0.8	1.1	4.2	1.8	1.9	7.5	9.4	6.7	3.0
5	-7.0	1.6	1.4	3.5	2.0	1.9	7.5	7.1	5.6	2.9
6	-7.3	2.4	1.8	3.5	2.4	1.9	5.0	5.9	4.5	2.9
7	-7.3	0	0.4	3.5	1.1	1.9	7.5	14.1	9.0	3.0
8	-7.0	0.8	0.4	2.1	0.9	0	7.5	15.3	9.0	2.9
9	-8.1	0	0.4	4.9	1.5	1.9	10.0	12.9	9.0	3.3
10	-6.6	0	0.4	3.5	1.1	1.9	7.5	12.9	8.4	2.9
B. Second Ability Quartile										
1	-3.2	2.9	3.7	5.1	3.6	0	3.5	5.6	2.8	3.4
2	-3.2	2.9	3.7	5.1	3.6	0	3.5	5.6	2.8	3.4
3	-3.6	4.3	4.3	5.1	4.4	0	3.5	5.6	2.8	4.1
4	-4.1	2.9	3.7	6.8	3.9	2.4	10.3	11.1	7.6	4.7
5	-4.0	3.6	4.3	6.8	4.4	2.4	6.9	8.3	5.7	4.7
6	-4.5	4.3	5.5	6.8	5.3	2.4	6.9	8.3	5.7	5.4
7	-4.1	2.9	3.7	6.8	3.9	2.4	10.3	13.9	8.5	4.9
8	-4.0	3.6	3.7	5.1	3.9	0	10.3	16.7	8.5	4.9
9	-4.5	2.2	3.7	8.5	3.9	2.4	10.3	13.9	8.5	4.9
10	-3.4	1.4	2.5	6.8	2.8	2.4	10.3	13.9	8.5	4.1

Table 17--continued

Policy Alternative	Postsecondary Option									
	Noncollege	Public Colleges and Universities				Private Colleges and Universities				Total, All Colleges
		Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	
C. Third Ability Quartile										
1	-2.0	3.5	7.1	4.2	5.0	0	5.6	6.3	3.3	4.6
2	-2.0	3.5	7.1	4.2	5.0	0	5.6	6.3	3.3	4.6
3	-2.2	5.3	8.2	4.2	6.3	0	5.6	6.3	3.3	5.7
4	-2.4	3.5	7.1	8.3	5.4	3.7	11.1	12.5	8.2	6.0
5	-2.4	4.4	7.1	8.3	5.9	0	11.1	12.5	6.6	6.0
6	-2.9	5.3	9.4	8.3	7.2	3.7	11.1	6.3	6.6	7.1
7	-2.4	3.5	7.1	8.3	5.4	0	11.1	12.5	6.6	5.7
8	-2.5	4.4	7.1	8.3	5.9	0	11.1	12.5	6.6	6.0
9	-2.4	3.5	7.1	8.3	5.4	3.7	11.1	12.5	8.2	6.0
10	-2.0	2.7	4.7	8.3	4.1	0	11.1	12.5	6.6	4.6
D. Lowest Ability Quartile										
1	-1.0	2.5	7.3	0	3.9	0	10.0	20.0	6.9	4.4
2	-0.8	2.5	7.3	0	3.9	0	10.0	20.0	6.9	4.4
3	-1.1	12.7	9.8	0	10.9	0	10.0	20.0	6.9	10.1
4	-1.0	2.5	7.3	0	3.9	7.1	10.0	20.0	10.3	5.1
5	-1.0	2.5	7.3	0	3.9	7.1	10.0	20.0	10.3	5.1
6	-1.2	3.8	9.8	0	5.4	7.1	10.0	20.0	10.3	6.3
7	-1.0	2.5	7.3	0	3.9	7.1	10.0	20.0	10.3	5.1
8	-1.1	12.7	9.8	0	10.9	0	10.0	20.0	6.9	10.1
9	-1.0	2.5	7.3	0	3.9	7.1	10.0	20.0	10.3	5.1
10	-0.7	1.3	4.9	0	2.3	7.1	10.0	20.0	10.3	3.8

Table 18

RELATIVE EFFECTIVENESS OF ALTERNATIVE POLICIES FOR SELECTED STUDENT POPULATIONS

Student Population	Policy Alternative									
	1	2	3	4	5	6	7	8	9	10
A. All Colleges										
All	9	9	8	1	5	1	3	6	3	7
White males	9	9	8	3	3	2	3	3	1	7
White females	10	9	7	4	4	1	4	3	1	7
Nonwhite males	9	2	9	2	6	2	1	2	6	6
Nonwhite females	5	5	3	5	5	1	4	1	5	10
Low-income	8	8	3	4	4	1	7	2	4	10
Lower-middle income	10	9	8	2	2	5	4	6	1	7
High ability	9	9	8	2	4	4	2	4	1	4
Upper-middle ability	9	9	7	5	5	1	2	2	2	7
Lower-middle ability	8	8	6	2	2	6	1	2	2	8
Low ability	8	8	1	4	4	3	4	1	4	10
B. Public Colleges										
All	5	5	2	2	2	1	5	5	5	10
White males	4	4	2	4	2	1	8	8	7	8
White females	7	7	3	5	2	1	7	5	4	10
Nonwhite males	2	2	2	2	2	1	2	8	8	8
Nonwhite females	4	4	2	7	7	1	6	2	7	10
Low-Income	4	4	2	7	4	1	7	3	7	10
Lower-middle income	6	6	5	3	1	1	6	9	4	10
High ability	4	4	2	4	3	1	8	10	7	8
Upper-middle ability	8	8	2	4	2	1	4	4	4	10
Lower-middle ability	8	8	2	5	3	1	5	3	5	10
Low ability	4	4	1	4	4	3	4	1	4	10
C. Private Colleges										
All	8	8	8	3	6	7	1	5	1	3
White males	8	8	8	5	6	6	2	2	1	4
White females	9	8	9	4	6	7	1	1	1	4
Nonwhite males	9	3	9	3	7	7	1	1	3	3
Nonwhite females	7	7	7	1	1	7	1	5	1	5
Low-income	8	8	10	2	5	6	4	1	2	6
Lower-middle income	9	8	9	5	6	7	2	2	1	2
High ability	8	8	8	5	6	7	1	1	1	4
Upper-middle ability	8	8	8	5	6	6	1	1	1	1
Lower-middle ability	8	8	8	1	3	3	3	3	1	3
Low ability	7	7	7	1	1	1	1	7	1	1

NOTE: Policies are ranked from 1 (most effective) to 10 (least effective) by percentage changes in numbers of students induced to attend colleges of indicated type.

effect) to tenth (least effect). Tables 18B and 18C similarly show the rankings of each policy for various groups of students in terms of its effect on the numbers of high school graduates who would go on to public and to private colleges.

The sixth policy (current rules with $1800 ceiling, half cost, full need, $200 minimum, and scheduled reduction with a $1400 effective ceiling) would stimulate the greatest increase for all students and for most subpopulations of students. This increase would be largely concentrated in public institutions. The sixth policy is the most influential of the ten on public enrollments for every subpopulation, but its effect on enrollments in the private sector is relatively weak.

The fourth (current rules with $2000 ceiling, full cost, half need, and $200 minimum), seventh (Greater Tuition Sensitivity), and ninth (Quie's Proposal) policies also have large aggregate enrollment effects. The fourth has a balanced effect, relatively large for both the public and private sectors. The seventh and ninth have relatively large effects on private sector enrollments; they are the most efficacious of the ten policies in that regard. Both, however, have only mild effects on enrollments in the public sector.

The first policy (current award rules with $1400 ceiling, half cost, full need, $200 minimum) and second policy (current award rules with $1400 ceiling, full cost, half need, $200 minimum) are generally the least effective in stimulating either aggregate or private sector enrollments. They have mild effects on public sector enrollments.

The third policy (current award rules with $1400 ceiling, full cost, full need, $200 minimum) and tenth policy (Proportional Need Sharing) also have weak effects on aggregate enrollments. Their respective effects on public and private enrollments are diametrically opposed. The third policy is one of the strongest from the perspective of public colleges, but is the weakest from that of the private sector. Conversely, the tenth policy has the least influence of the ten on public enrollments, but is effective in the private sector.

The fifth policy (current award rules with $2000 ceiling, half cost, full need, $200 minimum) and eighth policy (COFHE Proposal) fall toward the middle of the rankings in their aggregate effects. The

fifth has a strong influence in the public sector and only a mild effect in the private. The eighth has little effect in the public sector and, for all students, a mild effect in the private; however, it is a relatively strong private sector policy for some of the student subpopulations.

V. FURTHER APPLICATIONS OF THE MODEL

The model exists now as a computer program capable of varying BEOG award parameters and the categories of student and institutional characteristics for which the results are reported. We describe the current status of the program below, and then give examples of extensions that we think may be of interest.

CURRENT STATUS

The time and resources available for this study did not permit development of the model to the point of its being an easily accessible "package." It exists in the form of two computer programs and associated data sets. Program 1 performs the simulations and outputs student-by-option choice probabilities onto a machine-readable file. Program 2 aggregates these results by specified categories and prints them. Many different kinds of needs can be served, but some require replacing subroutines rather than inserting simple control cards.

It is easy to obtain estimated effects of changing the award parameters in any of the six sets of award rules considered earlier. We have prepared a subroutine for each alternative that computes institution-specific BEOG awards for each student according to the parameters specified for a given run. For example, the COFHE proposal may be regarded as a special case of a six-parameter award policy in which the basic grant is

$$X_1 - \text{noninstructional costs},$$

and the supplementary grant is the

$$\text{lesser of} \begin{cases} X_2, \text{ or} \\ X_3\,[\text{instructional costs} - X_4 \\ \qquad - (\text{family contribution} - X_5)], \end{cases}$$

subject to a minimum of X_6. An input data card specifying the values of X_1 through X_6 is all that is needed.

A run of this type on an IBM 370/158 requires about 575 CPU seconds and 470K core storage. A simpler version of the simulation program, which omits disaggregation by state of residence, requires about 400 CPU seconds and 350K core storage. Costs are greatly reduced by performing simulations of several alternatives in parallel. Eight alternatives examined in one pass required about 900 CPU seconds and 470K core storage.

It would be somewhat more difficult to examine award rules different from the types we considered. A FORTRAN subroutine would have to be developed to compute the award a student would receive at each institution, given his or her family contribution (and other relevant characteristics).

Aggregation of the estimates for different institutional categories can easily be accomplished. The aggregation program calls a dummy subroutine that assigns each college to one of six categories. The dummy subroutine can be replaced by a FORTRAN subroutine that assigns institutions to categories according to any desired criteria. For example, the results could be compiled for institutions categorized by control (public or private), level (junior college, four-year college, or university), cost, location, etc.

Aggregation of the estimates for different classes of students is more difficult. At present, the aggregation program prints the results for students within race by sex by ability by income classifications. The aggregation program would have to be modified to alter this categorization.

POSSIBLE EXTENSIONS

The model is basically a device for estimating the probability that each student will enroll at a particular institution of higher education, given certain assumptions. By changing those assumptions, performing a simulation for each alternative set of assumptions, and comparing the results, we can obtain estimates of how changes in the higher educational environment will influence enrollment rates and

patterns. The model can thus be used to cast light on any issue in which student behavior plays a part. Some examples are given below.

The cost of implementing a BEOG award policy is clearly an important consideration in choosing among policies. Unfortunately, the time and resources available for this study precluded our investigating that aspect of the problem. However, the model can be readily adapted to estimate the aggregate cost of a set of BEOG award rules and the flows of federal funds to various types of students and institutions. This could be done by computing the expected grant for each student at each institution (the product of the probability that the student goes there and the size of the grant the student would thereupon receive), weighting for the student's representation in the national population of high school graduates, and aggregating over all or over selected types of students and institutions.

The aid-computation subroutine also computes the offset, if any, to a student's aid from other sources resulting from his or her receipt of a BEOG award. The effects of alternative assumptions regarding other aid programs and their interaction with the BEOG program could be estimated by developing an appropriate subroutine. For example, we assumed that there were no tradeoffs between BEOG awards and financial aid from other sources. We could, instead, assume that specified tradeoffs would be imposed by federal, state, institutional, or other aid-granting programs, and examine the implications of those assumptions for flows of funds and students. In this way, we could address the question, "What would be the effects of terminating the work-study program and using the funds to support a more generous BEOG award policy?"

We assumed the current rules for computing family contributions and the costs of attending a college. The model could be used to explore the effects of modifying the family contribution schedule, allowances for books and supplies, personal expenses, room and board costs for students living at home, and so forth.

The model can also be used to explore the interactions of state and federal aid programs. For that matter, it can be used at the state level to investigate the likely consequences of alternative state financial aid policies.

Appendix A

THE DATA BASE

THE STUDENT DATA*

The NLS was initiated in the spring of 1972. Its sample design included 18 seniors from each of 1200 high schools. However, the baseline survey was implemented so late in the school year that several high schools were unable to participate, and a few others were not eligible for participation for various reasons. Where possible, schools from a backup sample were substituted for nonparticipating primary sample schools. In all, 17,726 students from 1044 schools (949 primary sample schools and 95 backup sample schools) took part in the baseline survey.

The first-follow-up survey was conducted in October 1973. Questionnaires were directed to all students in the initial sample, including those from nonparticipating primary sample schools. The survey also included the students from the backup sample schools included in the baseline survey, and random samples of 18 students from each of a small number of "augmentation" schools selected to represent schools not included in the sampling frame. Short versions of the baseline questionnaire were added to the follow-up questionnaires directed to students from the schools that had not participated in the baseline survey. The full NLS data base, including all students from the primary, participating backup, and augmentation samples, comprises 22,532 students.

Data were obtained from six instruments. Information on each high school's services, staff, and facilities was obtained from a questionnaire addressed to the school's principal. Each school's counselors provided information on their activities in another questionnaire. Another instrument directed to the schools obtained data for each NLS student from his or her school records. A baseline questionnaire sought information from each student regarding his or her background, high school experiences, attitudes, and plans for the future. A six-part battery of standardized tests was administered to the students participating in the baseline

*See Ref. 5 for a full description of the available student data.

survey. Finally, the first-follow-up instrument sought data on students' activities since leaving high school and their plans for the future. (Entire instruments are unavailable for many students and data are often missing on the available instruments.)

THE ANALYSIS SAMPLE

Three instruments, the baseline and first-follow-up questionnaires and the test battery, provide information required for the analysis. The baseline survey is our source of information on students' backgrounds and characteristics. A special version of the first-follow-up instrument, directed to students from schools that had not participated in the baseline survey, supplied some background data, but several of the variables that enter the ICF model were not included. The test battery is our source of information on students' ability, and the first-follow-up questionnaire identified students' postsecondary enrollment behavior. The 7453 students for whom one or more of these instruments were not available were dropped from the analysis.*

A total of 248 students did not respond to the sex, race, or high school program items on the baseline instrument. Because these are important factors in the college-going/college-choosing decision, we dropped these students as well.

There were numerous problems in the FICE codes for the schools students attended or considered. We took several different actions (outlined below) to reconcile the data. Nonetheless, there remained 700 students who apparently continued their education beyond high school but who could not be "located" at a specific institution. They, too, were dropped from the sample.

In all, we deleted 8401 students. The sample for the analysis thus comprises 14,131 students. Table A.1 shows the enrollment distribution of the analysis sample students.

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*The missing instruments consist of 5849 baseline questionnaires, 6672 test batteries, and 1182 first-follow-up questionnaires. Nearly all the students who did not respond to the baseline questionnaire also failed to take the test battery, and both the baseline and first-follow-up questionnaires were missing for about 400 students.

Table A.1

ENROLLMENT DISTRIBUTION OF ANALYSIS SAMPLE STUDENTS

Enrollment Status, October 1972	Number of Students
Not full-time students	7496
Full-time students	6635
Vocational-technical schools ...	818
Colleges and universities	5817
Private	1380
Public	4437
Two-year	1680
Four-year	2757

IMPUTING INCOME

The analysis sample included 2949 students who had not reported their family's income. Rather than dropping so many observations, we attempted to impute income where the data were missing. The NLS obtained only a gross categorical measure of family income. And previous studies have shown that students' reports of their family income are inaccurate,* implying considerable error in the available data. Accordingly, we felt that a crude imputation scheme would suffice for our purposes. We regressed the logit of the percentile** of each reporting student's family income on a series of dummy variables corresponding to the father's occupation (15 categories), and education (5 levels), mother's education (5 levels), and race. We used the regression coefficients to impute income percentiles for the students who did not respond to the income item on the basis of their parents' occupations and educations, and assigned each of them the income category in which the imputed percentile fell.

Table A.2 presents the results of the income imputation regression.

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*See Ref. 6, for example.

**The NLS income categories have unequal intervals and the uppermost category is open-ended. We transformed each categorical response to the midpoint of the category's interval in the cumulative percentage distribution of all NLS students' reported family income.

Table A.2

RESULTS OF INCOME IMPUTATION REGRESSION

Variable	Coefficient	T
Constant[a]	-2.208	-10.10
Father's occupation:		
Clerical	0.22	2.48
Craftsman	0.20	4.53
Farmer	-0.26	- 3.83
Homemaker	-0.06	- 0.16
Laborer	0.01	0.18
Manager, administrator	0.80	15.53
Military	0.31	3.50
Operative	0.16	3.18
Professional	0.79	13.92
Proprietor	0.77	11.93
Protective service	0.41	4.30
Sales	0.56	8.22
Service	-0.26	- 2.63
Technician	0.51	5.45
Father's education:		
Less than high school	0.49	2.56
High school graduate	0.87	4.55
Some college	1.17	6.06
College graduate	1.51	7.66
Postgraduate degree	1.70	8.54
Mother's education:		
Less than high school	-0.20	- 0.86
High school graduate	0.24	1.02
Some college	0.37	1.57
College graduate	0.60	2.52
Postgraduate degree	0.65	2.67
Race	0.83	24.85

NOTE: N = 11,748; R^2 = 0.33; F = 234.2

[a]Excluded dummies: father's occupation unknown, father's education unknown, mother's education unknown.

FICE CODES

Each student was asked the name, location, and type of six schools: the school he or she attended in October 1973, the school he or she attended in October 1972 (if different from the 1973 institution), the school he or she attended at any other time since high school, and the schools that were his or her first, second, and third choices at the time he or she first applied for admission to any postsecondary institution. (We denote these institutions FICE1 through FICE6, respectively.) FICE codes were subsequently substituted for the schools' names.

These FICE codes present numerous problems: Many are so-called "all-campus" codes; others refer to institutions not located in the city (or, occasionally, even the state) named by the student; still others refer to institutions of a different type from that given by the student; and some codes cannot be identified. We substituted the FICE code of the main campus (or the largest campus, if there was no clearly defined main campus) for each "all-campus" FICE code. If the coded school's location differed from that given by the student and there was one and only one school of the type identified by the student in the city named by the student, we substituted its FICE code for the one given in the NLS. We assumed that a student attended the coded school if it was located in the city named by the student even when its type was not consistent with the type of school identified by the student. We made no attempt to impute unidentifiable codes.

There remained 1876 student records with one or more problems in the FICE codes. As the codes for the FICE1 and FICE3 through FICE6 colleges are not of central importance, we neglected invalid codes in those fields. The models do not require institutional information for vocational-technical schools; consequently, if a student said that his or her FICE2 school was a vocational-technical institution, we neglected any problem in the FICE2 code. There were 700 students who apparently attended a college or university in October 1972, but whose school could not be determined. These students could not be included in estimating the Rand model. In the interest of fitting the ICF and Rand models on identical data, the 700 observations were dropped from the sample.

INSTITUTIONAL DATA

Our basic source of information on the attributes (quality, cost, etc.) of the institutions considered and/or attended by each student is the 1972 Institutional Domain File (IDF) compiled by the American Council on Education. Missing-data problems included institutions of higher education considered or attended by NLS students but not included in either the IDF or the College Board File, and missing information on important variables for included institutions. In both cases, we consulted standard sources (the Higher Education Directory [7], the College Handbook [8], Profiles of American Colleges [9], and the like) and entered the required information into the institutional file, which included 2509 institutions.

DISTANCE

We obtained each NLS high school's zip code from the National Center for Educational Statistics, and zip codes for institutions of higher education from standard sources. A file available from the Defense Civil Preparedness Agency of the Department of Defense was then used to obtain the geographical coordinates of each zip code's center of (population) gravity. A standard navigational subroutine was used as needed to compute great-circle distances, in miles, between high schools and colleges.

Appendix B

SIMULATION PROCEDURE DETAILS

FAMILY CONTRIBUTIONS

We employ the standard procedure for calculating students' family contributions. Figure B.1 is a sample of the worksheet used to calculate a student's family contribution. Data required to perform the computations, but not available in the NLS, were imputed as follows.

Family Size

The NLS obtains the number of a student's siblings dependent on his or her parents or guardians, but does not indicate whether the student is dependent on the parents or lives with both, one, or neither of them. In all cases, we assume that the students are dependent members of a two-parent family.

Income Taxes

The Office of the Assistant Secretary for Planning and Evaluation provided tables showing, by family size, the average 1975 income taxes paid by families in eight broad income categories. We regressed average taxes paid on income (the midpoint of each categorical interval), income squared, family size, and an income-by-family-size interaction term.* We then used the equation to impute the income taxes paid by each student's family on the basis of the midpoint of the student's reported family income category and family size.

Assets

We also obtained tables showing the average family assets of families in eight income categories. We regressed mean assets on income (the

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*$T = \underset{(-0.37)}{-22.67} + \underset{(33.25)}{.12Y} + \underset{(51.64)}{2.50\times10^{-6}\,Y^2} - \underset{(-9.54)}{79.28S} - \underset{(-13.89)}{4.18\times10^{-3}YS}$

where T = taxes, Y = income, and S = family size. $R^2 = .999$, $F = 23{,}959.4$.

CASE STUDY #1

A dependent applicant whose father is deceased. The mother earned $6,500 for the year. The applicant and his brother are both in college and the family received $1,620 per year from Social Security Benefits. The family has $20,500 in net assets from $20,000 in home equity and $500 in savings. The applicant has $300 in savings.

CALCULATION OF ELIGIBILITY INDEX
FOR DEPENDENT STUDENTS, ACADEMIC YEAR 1976-77
SUMMARY OF CALCULATIONS

TO BE USED FOR APPLICANTS REPORTING NO FARM OR BUSINESS ASSETS

1. Parents' adjusted gross income in 1975.		6,500
a. Amount earned by father.	0	
b. Amount earned by mother.	6,500	1,620
2. Total non-taxable income in 1975.		0
3. One-half of Veterans Educational Benefits (to be received between July 1, 1976 and June 30, 1977).		8,120
4. Annual Adjusted Income (lines 1+2+3).		300
5. Parents' Federal Income Tax paid for 1975.		7,820
6. Effective family income in 1975.		
7. Family size offset.	5,600	.
8. Unusual expenses.	0	
9. Employment expense offset.	1,500	7,100
10. Total offsets against income (lines 7+8+9).		720
11. Discretionary income (line 6 minus line 10).		
12. If line 11 is a positive amount, multiply discretionary income by applicable rate ($1-$4,999 @ 20%; $5,000 or more, $1,000 + 30% of amount in excess of $5,000) to obtain standard contribution from income. If line 11 is a negative amount, enter 0.		144
13. Determine net assets of parents.		20,500
14. Subtract asset reserve.		-12,500
15. Available parental assets (line 13 minus line 14).		8,000
16. Multiply available parental assets by 0.05.		400
17. Enter line 16 as standard contribution from available parental assets. If line 16 is negative, enter 0.		400 400
18. If line 11 is a negative amount, enter that amount as a positive number, otherwise enter 0.		0
19. Subtract line 18 from line 17 to obtain contribution from parallel assets. If negative number enter 0.		400
20. Add lines 12 and 19 to obtain contribution from family income and parental assets.		544
21. Multiply line 20 by multiple student rate to determine expected family contribution for each member in postsecondary education.		381
22. Determine net assets of student.		300
23. Multiply student's net assets by 0.33.		99
24. Student Eligibility Index equal sums of lines 21 and 23.		480

SOURCE: U.S. Office of Education, *1976-77 Determination of Basic Grant Eligibility Index*, Washington, D.C., n.d. (pamphlet).

Fig. B.1--Sample case study: calculation of eligibility index for dependent students

Table B.1

FAMILY SIZE OFFSET

Family Size	Dollar Amounts	Family Size	Dollar Amounts
1	1,000	7	8,300
2	3,650	8	9,150
3	4,400	9	10,000
4	5,600	10	10,850
5	6,600	11	11,700
6	7,500	12	12,550

SOURCE: U.S. Office of Education, *1976-77 Determination of Basic Grant Eligibility Index*, Washington, D.C., n.d. (pamphlet).

Table B.2

MULTIPLE STUDENT CALCULATION RATE

Postsecondary Education	Calculation Rate
1	100%
2	70%
3	50%
4 or more	40%

SOURCE: U.S. Office of Education, *1976-77 Determination of Basic Grant Eligibility Index*, Washington, D.C., n.d. (pamphlet).

midpoint of each categorical interval), income squared, and income cubed.* The resulting equation was used to impute the assets of each student's family on the basis of the midpoint of the student's reported family income category. We neglected the special treatment of farm or business equity assets.

Expense Allowances

We assume no unusual expenses and no special employment expenses.

*$A = \underset{(28.44)}{1.94\times10^{4}} + \underset{(5.26)}{.86\,Y} - \underset{(-4.07)}{4.38\times10^{-5}\,Y^{2}} + \underset{(4.60)}{9.37\times10^{-10}Y^{3}}$

where A = assets and Y = income. R^2 = .996; F = 227.7.

Number of Siblings in College

The NLS provided information on the number of siblings in college.

POSTSECONDARY ALTERNATIVES

The model can be used to estimate the probability that a student will attend each college in the country, but the estimated probability rapidly declines with distance. We believed that a simulation of students' choices among the options of no more education, vocational-technical school, and the institutions of higher education "near" his home would lead to reasonably accurate predictions and would be much less expensive; arbitrarily, we chose a 50-mile radius.

In a simulation, we estimate the probability that a student will attend each institution in a representative set of institutions that will accept students of his or her race and sex. The set comprises the nearest of each of six types: public two-year college, public four-year college, public university, and low-tuition (less than $1210), medium-tuition (between $1210 and $1725), and high-tuition (more than $1725) private schools. The set also comprises all other public and private colleges and universities located within 50 miles.

FINANCIAL AID FROM OTHER SOURCES

In estimating the effect of a BEOG award on students' enrollment behavior, we attempted to take account of the financial aid available from other sources.

The NLS obtained information on the financial aid each student received from all sources at the college he or she attended. It also requested information on the amounts of institutional aid the student was offered at other schools where the student applied for aid. We had to impute the amounts of noninstitutional aid each student would have received had he or she gone to one of those other schools, and the total amounts of aid the student would have received had he or she gone on to one of the schools in the student's simulation set to which he or she did not apply for aid.

We reasoned that students' choices are conditioned by their expectations. Consequently, their enrollment behavior would reflect the

amounts of aid they thought they would receive if they were to attend any particular institution. From this perspective, it seemed reasonable to assume that a student did not expect to get institutional aid from a school other than the one attended if he or she did not even apply for aid there. We also assumed that students would expect to receive about the same amounts of aid from state aid programs were they to attend any in-state institution. Some state aid programs discriminate among institutions, and the magnitude of an award may vary from one institution to another (e.g., as a function of cost). But lacking information on students' knowledge and understanding of the intricacies of their states' aid programs, we thought it reasonable to assume that they would view state aid as flat grants or loans.

Students can also receive aid from sources other than institutional or state aid programs. Social Security benefits and scholarships from private organizations are examples, as are bank loans, which students can use to attend any school they choose. We assumed that a student's aid from these sources would be the same at all schools.

We divided the aid received at the student's chosen institution into seven categories: general grants (Social Security and Veterans Administration benefits and "other" scholarships), general loans (guaranteed student loans and regular bank loans), state grants, state loans, college-specific grants (grants and scholarships from all institutionally based programs), and work-study (which is an institutionally based program having no counterpart at the state or general levels). We then computed a student's net cost variable at each institution as its gross cost (tuition, room and board, etc.) less general grants, state grants (assumed to be zero if the institution is out of state), and college-specific grants (if the student reported an aid offer from the institution). The aid variable is computed as the sum of general loans, state loans (if the institution is in-state), college-specific loans (if offered by the institution in question), and work-study (if offered by the institution).

ESTIMATING THE BASELINE PROBABILITIES

We use the procedure described in Sec. II to compute the probabilities that a student will choose the no-more-education option, a vocational-technical school, and each of the institutional options in his or her representative set.

WEIGHTS

The NLS comprises random samples of students drawn from a stratified random sample of high schools. Each student's weight in the original sample was calculated as the inverse of the product of the probability that the student's high school would be included in the sample and, given that it was, the probability that he or she would be drawn. We dropped 8401 observations where data required for the analysis were missing, and therefore had to revise each retained student's weight.

We first summed students' weights by high school stratum for both the original sample and the sample of students used in this analysis, and then computed the ratio of those two numbers for each high school stratum.

BEOG AWARDS

Given a specific BEOG award policy, we compute the size of the BEOG award each student would receive at each institution in his or her representative set. In making these computations, we assume that the cost of attending an institution equals its tuition and fees plus room and board costs (assumed to be the institution's room and board charge if it is located more than 30 miles away, and $1100--the BEOG allowance for students living at home--if it is located within 30 miles of the student), plus allowances of $400 for personal expenses and $150 for books and supplies.

Because the model is estimated on 1972 data, an inflation adjustment is needed. Since all our data on both students and colleges are for 1972, it is convenient to adjust the award rules to "equivalent" 1972 award rules and perform the simulation in 1972 dollars. The required adjustment consists of dividing all award parameters expressed in dollar amounts (e.g., the ceiling) by 1.33, the ratio of the Consumer Price

Index in the fall of 1976 to its value in the fall of 1972. For example, the set of 1976 award rules that allow a student the minimum of a $1400 ceiling less his family contribution, half cost, or full need, provided that it exceeds $200, is equivalent to a set of 1972 award rules which allow a student the minimum of $1053 less his family contribution, half cost, or full need, provided that it exceeds $150.*

In general, we assume that a BEOG award is a net addition to amount of aid a student receives. That is, we assume that other sources of aid do not adapt their programs and policies to the availability of BEOGs. However, many other aid programs are need-based; and it would be unreasonable to assume that those programs would furnish as much aid to a student if he or she also received a BEOG award large enough to cause the sum total of aid to exceed the gross cost of attending an institution. Accordingly, we assume that BEOG awards will be sufficiently offset by reductions in aid awards from other sources to equalize gross cost and total aid.

Specifically, we compute the BEOG award a student would receive at a particular institution, neglecting all other aid. We then subtract the sum of the BEOG and all aid from other sources from the gross cost of attending the institution. If cost net of all aid is greater than zero, we assume that the student would receive the full BEOG with no offsets in other aid. If cost net of all aid is less than zero, we then compare the gross cost of attending the institution with the amount of aid from other sources available to the student. If the gross cost is greater than the sum of the student's other aid, as it usually is, we assume that the student receives the full BEOG award to which he or she is entitled, but that aid from other sources is reduced enough to render gross cost just equal to the sum of the BEOG and the reduced aid from other sources. In computing these offsets, we assume that loans and work-study awards are reduced first. Other scholarships are reduced only by the excess of the required offset over the amounts of loan and work-study awards available to the student.

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*Because our data are for 1972, cost and family contribution and, therefore, need are expressed in 1972 dollars at the outset.

Finally, there is a small number of cases in which a student's aid from other sources exceeds the gross cost of attending an institution. Here we assume that the BEOG award is fully offset by reductions in other awards, first in the form of reduced loans and work-study and, if an excess remains after they are exhausted, by reductions in other scholarships.

SIMULATING THE EFFECTS OF FINANCIAL AID POLICY

One of the model's major advantages is the ease and low cost of using it to simulate the effects of financial aid policies. Given a student's characteristics--high school track, ability, income, and location--the probability that he or she will choose any particular institution is proportional to a function of a quadratic form in the net cost (gross cost minus scholarships) the student would incur by enrolling there. The award of a BEOG would reduce that net cost and, consequently, change the probability that he or she would enroll at the institution by an amount proportional to a function of a quadratic form in the size of the grant. The same relationship applies to each of the student's options.

When we performed the "base case" simulation, we computed the coefficients of the quadratic form for each of the institutions in each student's representative set. Given the BEOG award the student would receive by attending one of his or her options, its coefficients are used to compute the quadratic form and revise the probability that the student will choose it. Replicating the procedure over the full sample of students, we obtain the predicted frequency distribution of students over options, given the assumed award rules, which can then be weighted and aggregated to obtain a prediction of the national frequency distribution of students over option types that would be induced by the hypothesized award rules.

Appendix C

ADDITIONAL TABULAR DATA ON SIMULATION RESULTS

Table C.1

ESTIMATED PERCENTAGE DISTRIBUTIONS OF ALL STUDENTS' POSTSECONDARY CHOICES UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
		Public Colleges and Universities				Private Colleges and Universities				
	Noncollege	Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	Total, All Colleges
Baseline	57.4	11.6	14.9	6.2	32.7	3.5	2.5	3.8	9.8	42.5
1	56.1	11.9	15.4	6.4	33.7	3.5	2.6	4.0	10.1	43.8
2	56.1	11.9	15.4	6.4	33.7	3.5	2.6	4.0	10.1	43.8
3	55.9	12.0	15.5	6.4	33.9	3.5	2.6	4.0	10.1	44.0
4	55.7	11.9	15.4	6.6	33.9	3.6	2.8	4.2	10.6	44.5
5	55.8	12.0	15.4	6.5	33.9	3.6	2.7	4.1	10.4	44.3
6	55.5	12.1	15.6	6.5	34.2	3.6	2.7	4.0	10.3	44.5
7	55.7	11.9	15.3	6.5	33.7	3.6	2.8	4.3	10.7	44.4
8	55.7	12.0	15.3	6.4	33.7	3.5	2.7	4.3	10.5	44.2
9	55.5	11.8	15.3	6.6	33.7	3.6	2.8	4.3	10.7	44.4
10	56.0	11.8	15.2	6.5	33.5	3.6	2.7	4.3	10.6	44.1

Table C.2

ESTIMATED PERCENTAGE DISTRIBUTIONS OF WHITE STUDENTS' POSTSECONDARY CHOICES UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
	Noncollege	Public Colleges and Universities				Private Colleges and Universities				Total, All Colleges
		Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	
					A. White Males					
Baseline	54.8	12.2	15.6	6.2	34.0	3.6	2.9	4.8	11.3	45.3
1	53.9	12.6	15.6	6.4	34.6	3.7	2.9	4.9	11.5	46.1
2	53.9	12.6	15.6	6.4	34.6	3.7	2.9	4.9	11.5	46.1
3	53.8	12.7	15.6	6.4	34.7	3.7	2.9	4.9	11.5	46.2
4	53.5	12.6	15.5	6.5	34.6	3.7	3.0	5.1	11.8	46.4
5	53.5	12.7	15.5	6.5	34.7	3.7	3.0	5.0	11.7	46.4
6	53.5	12.8	15.5	6.5	34.8	3.7	3.0	5.0	11.7	46.5
7	53.5	12.5	15.4	6.5	34.4	3.7	3.0	5.3	12.0	46.4
8	53.5	12.6	15.4	6.4	34.4	3.7	3.0	5.3	12.0	46.4
9	53.4	12.5	15.4	6.6	34.5	3.7	3.1	5.3	12.1	46.6
10	53.8	12.4	15.5	6.5	34.4	3.7	3.0	5.2	11.9	46.3
					B. White Females					
Baseline	56.7	11.4	15.3	6.9	33.6	3.6	2.7	3.5	9.8	43.4
1	54.8	11.7	16.1	7.1	34.9	3.8	2.8	3.6	10.2	45.1
2	54.8	11.7	16.1	7.1	34.9	3.8	2.8	3.7	10.3	45.2
3	54.6	11.9	16.2	7.1	35.2	3.8	2.8	3.6	10.2	45.4
4	53.2	11.6	16.2	7.2	35.0	3.9	3.0	3.9	10.8	45.8
5	53.2	11.8	16.3	7.2	35.3	3.8	2.9	3.8	10.5	45.8
6	53.0	11.9	16.5	7.2	35.6	3.8	2.9	3.7	10.4	46.0
7	53.2	11.6	16.1	7.2	34.9	3.8	3.0	4.1	10.9	45.8
8	53.2	11.8	16.1	7.1	35.0	3.8	3.0	4.1	10.9	45.9
9	53.1	11.6	16.2	7.3	35.1	3.9	3.0	4.0	10.9	46.0
10	54.7	11.5	15.9	7.2	34.6	3.8	3.0	4.0	10.8	45.4

Table C.3

ESTIMATED PERCENTAGE DISTRIBUTIONS OF NONWHITE STUDENTS' POSTSECONDARY CHOICES UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
		Public Colleges and Universities				Private Colleges and Universities				
	Noncollege	Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	Total, All Colleges
				A. Nonwhite Males						
Baseline	66.6	12.6	10.6	4.5	27.7	2.1	1.8	1.9	5.8	33.5
1	66.2	12.0	11.4	4.4	27.8	2.0	1.9	2.0	5.9	33.7
2	66.2	12.0	11.4	4.4	27.8	2.0	1.9	2.2	6.1	33.9
3	66.2	11.8	11.6	4.4	27.8	2.0	1.9	2.0	5.9	33.7
4	66.1	12.0	11.4	4.4	27.8	2.0	2.0	2.1	6.1	33.9
5	66.1	12.0	11.4	4.4	27.8	2.0	1.9	2.1	6.0	33.8
6	66.1	11.8	11.7	4.4	27.9	2.0	1.9	2.1	6.0	33.9
7	66.1	12.0	11.4	4.4	27.8	2.0	2.0	2.2	6.2	34.0
8	66.1	11.8	11.5	4.4	27.7	2.0	2.0	2.2	6.2	33.9
9	66.1	12.0	11.3	4.4	27.7	2.0	1.9	2.2	6.1	33.8
10	66.1	12.2	11.1	4.4	27.7	2.0	1.9	2.2	6.1	33.8
				B. Nonwhite Females						
Baseline	64.5	9.7	13.7	4.8	28.2	3.5	1.1	2.6	7.2	35.4
1	62.8	9.8	14.8	5.4	30.0	3.2	1.2	2.8	7.2	37.2
2	62.8	9.8	14.8	5.4	30.0	3.2	1.2	2.8	7.2	37.2
3	62.4	9.9	15.0	5.4	30.3	3.2	1.2	2.8	7.2	37.5
4	62.8	9.7	14.6	5.5	29.8	3.2	1.3	2.9	7.4	37.2
5	62.8	9.7	14.6	5.5	29.8	3.2	1.3	2.9	7.4	37.2
6	62.3	9.8	15.0	5.6	30.4	3.1	1.3	2.8	7.2	37.6
7	62.8	9.7	14.6	5.6	29.9	3.2	1.3	2.9	7.4	37.3
8	62.3	9.9	14.9	5.5	30.3	3.1	1.3	2.9	7.3	37.6
9	62.8	9.7	14.6	5.5	29.8	3.2	1.3	2.9	7.4	37.2
10	63.1	9.7	14.4	5.4	29.5	3.2	1.2	2.9	7.3	36.8

Table C.4

ESTIMATED PERCENTAGE DISTRIBUTIONS OF LOW-INCOME AND LOWER-MIDDLE-INCOME STUDENTS' POSTSECONDARY CHOICES UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
	Noncollege	Public Colleges and Universities				Private Colleges and Universities				Total, All Colleges
		Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	
A. Low-Income Students[a]										
Baseline	77.6	8.9	8.6	1.7	19.2	2.2	0.4	0.6	3.2	22.4
1	72.2	10.1	11.0	2.5	23.6	2.3	0.8	1.0	4.1	27.7
2	72.2	10.1	11.0	2.5	23.6	2.3	0.8	1.0	4.1	27.7
3	71.3	10.7	11.5	2.5	24.7	2.2	0.8	1.0	4.0	28.7
4	71.8	10.0	10.8	2.6	23.4	2.3	1.1	1.4	4.8	28.2
5	71.8	10.1	10.9	2.6	23.6	2.3	1.0	1.3	4.6	28.2
6	70.2	10.7	11.9	2.7	25.3	2.3	1.0	1.2	4.5	29.8
7	71.9	10.0	10.8	2.6	23.4	2.3	1.0	1.4	4.7	28.1
8	70.9	10.6	11.2	2.5	24.3	2.2	1.0	1.7	4.9	29.2
9	71.9	10.0	10.8	2.6	23.4	2.3	1.0	1.5	4.8	28.2
10	73.5	9.6	10.0	2.3	21.9	2.2	0.9	1.4	4.5	26.4
B. Lower-Middle Income Students[b]										
Baseline	69.5	10.3	11.0	3.8	25.1	2.5	1.3	1.6	5.4	30.5
1	67.7	10.7	11.5	4.1	26.3	2.6	1.4	1.9	5.9	32.2
2	67.7	10.7	11.5	4.1	26.3	2.6	1.5	1.9	6.0	32.3
3	67.6	10.8	11.6	4.1	26.5	2.6	1.4	1.9	5.9	32.4
4	66.7	10.7	11.6	4.4	26.7	2.7	1.7	2.2	6.6	33.3
5	66.7	10.9	11.7	4.3	26.9	2.7	1.6	2.1	6.4	33.3
6	66.9	11.0	11.7	4.2	26.9	2.7	1.5	2.0	6.2	33.1
7	66.7	10.6	11.4	4.3	26.3	2.6	1.7	2.6	6.9	33.2
8	67.1	10.7	11.3	4.1	26.1	2.6	1.7	2.6	6.9	33.0
9	66.4	10.6	11.5	4.5	26.6	2.7	1.8	2.6	7.1	33.7
10	66.2	10.4	11.2	4.3	25.9	2.6	1.7	2.6	6.9	32.8

[a]Family income $6,000 or less.

[b]Family income between $6,000 and $9,999.

Table C.5

ESTIMATED PERCENTAGE DISTRIBUTIONS OF POSTSECONDARY CHOICES AMONG STUDENTS AT VARIOUS ABILITY LEVELS UNDER ALTERNATIVE FINANCIAL AID POLICIES

Policy Alternative	Postsecondary Option									
		Public Colleges and Universities				Private Colleges and Universities				
	Noncollege	Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	Total, All Colleges
A. Highest Ability Quartile										
Baseline	27.3	12.6	27.9	14.2	54.7	5.3	4.0	8.5	17.8	72.5
1	25.9	12.8	28.3	14.6	55.7	5.4	4.2	8.9	18.5	74.2
2	25.9	12.8	28.3	14.6	55.7	5.4	4.2	8.9	18.5	74.2
3	25.8	12.9	28.4	14.6	55.9	5.4	4.2	8.9	18.5	74.4
4	25.3	12.7	28.2	14.8	55.7	5.4	4.3	9.3	19.0	74.7
5	25.4	12.8	28.3	14.7	55.8	5.4	4.3	9.1	18.8	74.6
6	25.3	12.9	28.4	14.7	56.0	5.4	4.2	9.0	18.6	74.6
7	25.3	12.6	28.0	14.7	55.3	5.4	4.3	9.7	19.4	74.7
8	25.4	12.7	28.0	14.5	55.2	5.3	4.3	9.8	19.4	74.6
9	25.1	12.6	28.0	14.9	55.5	5.4	4.4	9.6	19.4	74.9
10	25.5	12.6	28.0	14.7	55.3	5.4	4.3	9.6	19.3	74.6
B. Second Ability Quartile										
Baseline	53.3	13.9	16.3	5.9	36.1	4.1	2.9	3.6	10.6	46.7
1	51.6	14.3	16.9	6.2	37.4	4.1	3.0	3.8	10.9	48.3
2	51.6	14.3	16.9	6.2	37.4	4.1	3.0	3.8	10.9	48.3
3	51.4	14.5	17.0	6.2	37.7	4.1	3.0	3.8	10.9	48.6
4	51.1	14.3	16.9	6.3	37.5	4.2	3.2	4.0	11.4	48.9
5	51.2	14.4	17.0	6.3	37.7	4.2	3.1	3.9	11.2	48.9
6	50.9	14.5	17.2	6.3	38.0	4.2	3.1	3.9	11.2	49.2
7	51.1	14.3	16.9	6.3	37.5	4.2	3.2	4.1	11.5	49.0
8	51.2	14.4	16.9	6.2	37.5	4.1	3.2	4.2	11.5	49.0
9	50.9	14.2	16.9	6.4	37.5	4.2	3.2	4.1	11.5	49.0
10	51.5	14.1	16.7	6.3	37.1	4.2	3.2	4.1	11.5	48.6

Table C.5--continued

Policy Alternative	Postsecondary Option									
	Noncollege	Public Colleges and Universities				Private Colleges and Universities				Total, All Colleges
		Two-Year	Low Tuition Four-Year	High Tuition Four-Year	Total Public	Low Tuition	Medium Tuition	High Tuition	Total Private	
C. Third Ability Quartile										
Baseline	71.8	11.3	8.5	2.4	22.2	2.7	1.8	1.6	6.1	28.3
1	70.4	11.7	9.1	2.5	23.3	2.7	1.9	1.7	6.3	29.6
2	70.4	11.7	9.1	2.5	23.3	2.7	1.9	1.7	6.3	29.6
3	70.2	11.9	9.2	2.5	23.6	2.7	1.9	1.7	6.3	29.9
4	70.1	11.7	9.1	2.6	23.4	2.8	2.0	1.8	6.6	30.0
5	70.1	11.8	9.1	2.6	23.5	2.7	2.0	1.8	6.5	30.0
6	69.7	11.9	9.3	2.6	23.8	2.8	2.0	1.7	6.5	30.3
7	70.1	11.7	9.1	2.6	23.4	2.7	2.0	1.8	6.5	29.9
8	70.0	11.8	9.1	2.6	23.5	2.7	2.0	1.8	6.5	30.0
9	70.1	11.7	9.1	2.6	23.4	2.8	2.0	1.8	6.6	30.0
10	70.4	11.6	8.9	2.6	23.1	2.7	2.0	1.8	6.5	29.6
D. Lowest Ability Quartile										
Baseline	84.2	7.9	4.1	0.9	12.9	1.4	1.0	0.5	2.9	15.8
1	83.4	8.1	4.4	0.9	13.4	1.4	1.1	0.6	3.1	16.5
2	83.4	8.1	4.4	0.9	13.4	1.4	1.1	0.6	3.1	16.5
3	83.3	8.9	4.5	0.9	14.3	1.4	1.1	0.6	3.1	17.4
4	83.4	8.1	4.4	0.9	13.4	1.5	1.1	0.6	3.2	16.6
5	83.4	8.1	4.4	0.9	13.4	1.5	1.1	0.6	3.2	16.6
6	83.2	8.2	4.5	0.9	13.6	1.5	1.1	0.6	3.2	16.8
7	83.4	8.1	4.4	0.9	13.4	1.5	1.1	0.6	3.2	16.6
8	83.3	8.9	4.5	0.9	14.3	1.4	1.1	0.6	3.1	17.4
9	83.4	8.1	4.4	0.9	13.4	1.5	1.1	0.6	3.2	16.6
10	83.6	8.0	4.3	0.9	13.2	1.5	1.1	0.6	3.2	16.4

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